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Henry W. Hall, Manager.

CHARLES W. PRICE.....Editor-in-Chief
A. A. GRAY.....Managing Editor
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ALLOWANCE FOR DEPRECIATION.

It is well recognized by those who give attention to the financing and accounting of large enterprises, whether manufacturing or operating in character, that depreciation of the property constituting the investment is an important item. Not only must it be considered in computing unit costs but provision should be made for the ultimate replacement of worn-out or obsolete apparatus, fittings and other objects, by the establishment of a sinking fund for this purpose. Many operating companies have been accustomed to make such provision for depreciation, and in these days when public-service rates are regulated either actually or prospectively by government commissions, it is imperative that every public-utility company, of whatever kind, should give proper attention to its depreciation account. Only when this element has been properly evaluated can a correct unit cost or just rate of charge be determined.

It is necessary to discriminate clearly between depreciation and maintenance and repairs. A proper expenditure for regular repairs may sometimes entirely prevent depreciation, as not infrequently occurs with buildings, for instance. Considered in connection with the ground upon which they stand, buildings may even increase in value. In the case of machinery, boilers, etc., it is hardly possible to make regular repairs which will maintain these objects permanently in their original condition of serviceability; moreover, such equipment as a rule becomes gradually obsolete on account of advances and new inventions in the industry, and this element of depreciation is the hardest for which to make proper allowance. Telephone apparatus has been particularly subject to this form of depreciation and little, if any, exchange equipment has been actually worn out.

The natural life of machinery or other apparatus may be determined with reasonable accuracy, but it is impossible to foresee the changed conditions which may make it advisable to relegate some particular equipment to the scrap heap.

In some companies, the entire consideration of depreciation has been completed at one stroke by writing off a percentage of the total investment which is supposed to constitute a reasonable allowance. In others, the property is classified according to probable life, and the investment in

each class is divided by the assigned number of years to determine the charge to be made against the income each year. In others, again, the yearly charge is graduated on a sliding scale, the total allowance being planned to equal the cost at the end of the useful life, as before, but the distribution is aimed to keep a proper relation to the actual value of the equipment. In the recent report of one large enterprise, we notice a yearly allowance of less than two per cent, which indicates that some future years must be charged with a large percentage of depreciation.

With any of these plans, it is hard to secure agreement as to what the proper yearly rate should be, and each instance must be decided according to the judgment of the man in authority, the decision being to a certain extent arbitrary, and to the same extent liable to error and unsatisfactory results.

A reasonable solution of the problem would seem to be found by throwing a large and disproportionate part of the cost on the early years of use, and a lesser proportion, or none at all, upon the later years. This would better take care of obsolescence occurring before the end of the natural life, owing to newer developments; and it would still result in a proper fund at the end, if the natural life were concluded. It would also make some provision against accidents, which of course cannot be foreseen. As far as possible, liabilities from accidents should be covered by insurance, but insurance cannot easily be made to cover all losses of this nature, and some of them are too serious to be covered by repair bills.

If a curve be plotted between value as vertical co-ordinate and time as horizontal co-ordinate, the result is a straight line for the case where the depreciation is distributed evenly over the life. Hence this method is often called the "straight-line" method. If the allowance for depreciation be small in the early years, and increased for later years, the curve will be concave toward the axes. This is usually the case where the allowance for depreciation is based upon a yearly appraisal. But if the allowance be made large in the early years, the curve will be convex toward the axes, and may reach zero before the termination of the natural life; if the use of the equipment is unexpectedly terminated, the curve is discontinued at a point nearer to the axis than by the previous methods, and this distance represents that part of the cost which has not been covered by a sinking fund.

Objection may be made to this method because it throws an undue depreciation charge upon those years when business is likely to be small, and a smaller charge upon the later years of prosperity. For this reason new companies might find it inexpedient, as applied to the original installation; but for later purchases, renewals, or extensions of plant, it would offer advantages. Railway companies have often found it necessary to rehabilitate before any adequate funds have been accumulated, and central stations have seen engines, transformers, etc., become obsolete long before they are worn out, and only because their efficiencies have been far exceeded by new apparatus. A depreciation allowance which provided a margin for contingencies of this kind would have proven a blessing to many a manager in the past, and may have opportunities of performing an equally welcome service in the future.

GLARE.

In a paper read at the convention of the Illuminating Engineering Society, and abstracted in our last issue, Mr. Preston S. Millar records some experiments in which the effect of glare in reducing visual discernment was measured. When the source of light producing glare was separated from the object under observation by an angle as great as sixteen degrees, the effect was negligible. As the light is brought nearer to the object, the effect increases at first at a uniform rate. At a certain critical angle, which varied somewhat with conditions, the rate suddenly changed, the effect increasing rapidly. When the source reaches the line of sight, the object can no longer be seen.

It is of interest to consider whether there may be a physiological explanation of the shape of this curve. The most sensitive portion of the retina of the eye, know as the "yellow spot," occupies an area about the direct line of vision having a diameter equivalent to about five degrees, or 2.5 degrees on either side of the center line. As this portion of the retina is most acute in discernment it would be reasonable to assume that it would also be most sensitive to the blinding effect of an extraneous source of light. In Mr. Millar's experiment with a sixteen-candlepower lamp as source, it is to be noticed that the rapid increase of effect begins at an angle of about 2.5 degrees. If similar effects were obtained under all circumstances, this might seem an adequate explanation of the sudden change in the slope of the curve. When a 150-candlepower lamp was used, however, the change took place at an angle of about eight degrees.

Mr. Millar does not state in his paper whether the source was placed in the same vertical plane as the object, or whether it was in the same horizontal plane, or an oblique plane. If it were in the same horizontal plane, one would expect to find the "blind spot" interfering with the smoothness of his curve. This blind spot occupies the part of the retina at which the optic nerve enters the eye, and it is entirely insensitive to light.

The subject appears to be one which demands further investigation, and similar observations should be made using various planes, sources of different angular sizes and with a variety of intensities. The structure of the eye should also be kept in mind while the observations are being taken, in order that the observations be arranged to

bring out any facts which might have a physiological bearing. It is also very desirable that observations should be made by a number of experimenters, in order that any personal abnormalities should not affect the conclusions. Similar experiments made by Mr. A. J. Sweet failed to reveal the abrupt change in rate reported by Mr. Millar.

FLAME STANDARDS IN PHOTOMETRY.

The constancy of candlepower which can be maintained by an electric incandescent lamp, well seasoned, and maintained at constant voltage, has put it in the front rank as a working standard. The tests which have been carried out at various standardizing laboratories have shown that a unit can be maintained for a reasonable period better in this way than in any other, and it has even been proposed that a primary standard be maintained by a group of such lamps, replacing the older ones from time to time with new ones whose value is determined in terms of the group. The only objection to this method is that there would be no way of independently determining the unit, and a gradual drift in its value would be possible.

The flame standards which have been in use abroad have not seemed capable of determining the unit with as great accuracy as comparisons of candlepower can be made, and for this reason they have seemed inadequate. The investigations which are being carried on at the Bureau of Standards, and which were reported by Dr. Rosa and Mr. Crittenden at the recent convention of the Illuminating Engineering Society indicate that a particular lamp used in a definite way will give results sufficiently reproducible for the purposes of a primary standard. Different lamps made in accordance with the present specifications show, however, too great differences in candlepower. It is to be noted that these differences are detected by comparison with an electric lamp, which thus demonstrates its superiority as a working standard. For flame photometry, however, it is more convenient to have a flame standard, since corrections for atmospheric humidity, etc., can be avoided when both lamps are similarly affected.

The results of this investigation indicate that with sufficiently comprehensive and rigid specifications, the unit of candlepower could be defined in terms of a flame standard, say a pentane lamp, with sufficient accuracy, and would be reproducible in the sense that different lamps, conforming to the specifications, could be set up and found to be in agreement within the limits of accuracy of observation.

When this research is completed it would be in order to call an international conference for the purpose of drawing up such suitable specifications, so that the unit so defined would have international sanction. The Illuminating Engineering Society took a prominent part in bringing about international action in the adoption of the international candle, and it would be quite proper for it to take the initiative in this matter.

REFRIGERATING AS A POWER LOAD.

The United States leads the nations of the world as a consumer of ice, not only in industrial establishments but also in retail stores and private houses. At present most of the ice used in this country is cut during the winter from our numerous lakes and rivers, stored in heat-insulated ice houses, and retailed all the year round, but mostly in the summer time, by numerous companies at profitable rates. When the demand is high, that is, of course, during the hot spells, prices rise, unlike the price of electricity which is constant all the year round.

The manufacture of ice by central stations as an off-peak load is a question which has received a great deal of attention in the technical press, but the sale of power to ice-using customers to make their own ice or to furnish their own refrigeration has not yet been exploited to the extent it deserves. Packing houses, wholesale and retail butchers, hotels, restaurants, and ice-cream manufacturers are perhaps the best prospective customers for this form of service.

Apart from the economy resulting from homemade refrigeration, which is pointed out by Mr. R. L. Lloyd in an article on "Electric Refrigeration in the Meat Industry," appearing on another page of this issue, there is the added advantage of better hygienic conditions which pertain to the domestic article. Inasmuch as a great deal of the ice which is harvested during the winter from natural bodies of water is contaminated with disease germs, it is rendered unsuitable for use in cases where the ice is brought into direct contact with food or drink for human consumption.

There is an enormous field for the motor-driven refrigerating machine, and the enterprising central-station manager will not neglect this great opportunity for establishing a profitable power load in his territory. In addition to the possibilities mentioned above it may be stated that there are plenty of householders who would be willing and even anxious to install a small motor-driven refrigerating outfit in their homes, were the proposition presented to them in the right way.

SOUND COPPER CASTINGS.

The discovery of a process for making sound copper castings of high electrical conductivity, as announced by Dr. E. Weintraub, director of the West Lynn research laboratory of the General Electric Company, at the recent convention in Chicago of the American Electrochemical Society, opens up a new era for the manufacturers of electrical transformers and other apparatus in which copper is used extensively. Hitherto, forged copper has had to be employed, and mechanical joints were necessary in the manufacture of the more intricate parts of the apparatus. With the advent of cast copper, these parts can be made in a single piece, and the slight loss in conductivity is more than compensated by the lack of joints, and in many cases the total cost is reduced.

Philadelphia Electric Company Section, National Electric Light Association.

The first meeting of the season of the Philadelphia Electric Company Section of the National Electric Light Association was held on Monday evening, October 17 last, in the assembly room of the main office of the Philadelphia Electric Company, 1000 Chestnut Street, Philadelphia, Section Chairman Joseph D. Israel presiding.

The meeting was opened with an address by the Chairman, in which he outlined all the work which it is hoped to accomplish during the ensuing season, particular mention being made of the work of the Membership Committee, which it was hoped will double the membership this season.

Strenuous efforts are being made to encourage all Company employees to become members of this Association, and judging from the results thus far the prospect is very bright.

The Chairman then introduced the speaker of the evening, John Meyer, who presented a paper on "Commercial Engineering." As the title suggests, the subject was a most interesting one, embracing every department of the Company.

After a brief review of the many trials of the solicitor in securing large contracts, particularly power installations, in which all the arguments used were presented, and also the probable questions of the proposed consumer, a few concrete cases were cited, in which the actual figures, showing the estimated income, and the results obtained, were shown; also the effect of these new installations on the station load curve. The lecture was illustrated with numerous lantern slides.

The paper caused considerable discussion, and it was the general opinion that the 1910-11 season of the Philadelphia Electric Company Section had been opened very auspiciously. There were in attendance 114 members and guests.

Metropolitan Taxes Settled.

The basis of settlement of the special franchise taxes of the Metropolitan Street Railway Company of New York, which have been in dispute for some time has been finally arranged by Comptroller Pendergast.

The terms of the settlement are that the Metropolitan Street Railway Company shall pay $3,750,000 and interest from March 31, 1910. The amount due for the term of the agreement was $5,568,563, but from this $2,653,666 is to be deducted under section No. 48 of the tax law, leaving a balance due the city of $2,914,836, with interest aggregating $835,163.

Association of Edison Purchasing Agents.

At the last regular meeting of the Association of Edison Purchasing Agents the present officers were re-elected. Those holding office are as follows: H. C. Lucas, president; W. H. Francis, vice-president; J. W. Brennan, second vice-president; A. W. Banks, Jr., treasurer, and J. J. Miley, stock controller.

Bloodless Electric Surgery.

According to cable dispatches from Berlin, Dr. F. Nagelschmidt has just demonstrated before the electro-therapeutic section of the Royal Society of Medicine his discovery of a method of performing surgical operations without shedding blood by employing a modification of the ordinary high-frequency electric current.

In Dr. Nagelschmidt's apparatus, which develops a larger current than the ordinary apparatus of this type, the electrodes are placed on each side of the part to be operated on. On application of the current the flow of blood in the region between the electrodes is stopped by the coagulation of the albumen in the blood and tissue. The area of coagulation can be widened or narrowed by using broader or narrower electrodes.

Dr. Nagelschmidt believes this method will be particularly useful in dealing with large surface cancers. He has successfully operated on three or four cancers and has also removed tonsils without loss of blood. There is difficulty, however, and except in skilled hands, danger in the operation, because there is some risk of blood coagulating in the large veins in the area between the electrodes, thereby forming clots and inducing fatal embolism.

This difficulty is met by application of vaseline ointment containing two per cent of pyrogallic acid, which retards otherwise too rapid healing, the result of which not only would be the encouragement of clotting, but the creation of redundant proud flesh and ugly scarring. If this is properly guarded against the method is declared to be an enormous advance on any now existing, as obviating shock from loss of blood.

Utah Society of Engineers.

The regular monthly meeting of the Utah Society of Engineers was held in the Society's headquarters, Newhouse Building, Salt Lake City, on October 21. A paper upon "Manganese Steel" was presented by F. E. Johnson, of the Edgar Allen American Manganese Steel Company, and the discussion led by J. P. Tempest, of the Utah Light & Railway Company.

Steel Requirements of the New York Subway.

Construction plans of the new subway system call for fourteen miles of four-track construction, seventeen miles of three-track construction, and thirteen miles of two-track. On a basis of 100-pound rails this trackage will require in the neighborhood of 25,000 tons of rails, with a valuation of approximately $700,000.

New Hudson Terminal to Open.

The new Broadway and Thirty-third Street terminal of the Hudson River tunnels will be opened for traffic November 10. The terminal station will have five entrances from the street. There are twelve staircases leading from the concourse to the track platforms below.

New York City's Railways.

In a table of statistics published by the New York Public Service Commission, First District, the number of passengers carried by the large street-railway companies up to June 30, 1910, is given as 1,526,966,988. The total net revenue for the year was nearly $37,000,000.

Standard Holders for Electric Lamps.

The British Engineering Standards Committee, 28 Victoria Street, Westminster, London, England, has recently issued its Report No. 52 containing a standard specification for bayonet socket electric lamp holders and caps.

Bids for New York Subway.

Although seventy-seven bids were opened for the new New York subway only one bid covered the entire route. This bid was made by the Bradley Contracting Company.

Francis B. Badt.

Among the men who have taken a prominent part in the development of the electrical industry and who stand foremost among the professional and business men of Chicago, Francis B. Badt occupies a commanding position. Combining with a delightful personality, a lengthy experience, during which time he has been associated with some of the most important work which has been carried out in this country, Lieutenant Badt, or "the Professor," as his intimate friends call him, is a most interesting subject for a sketch of this character.

FRANCIS B. BADT,
Electrical Engineer and Author.

Lieutenant Badt was born in 1849. He is a graduate of a royal gymnasium in Prussia, and joined the Prussian army, in the artillery branch, in 1868. He graduated from the military academy in 1870 and was appointed a commissioned officer in July of the same year.

In 1871 he was decorated by the emperor with an Order of the Iron Cross and a campaign medal. After the Franco-Prussian war of 1870 and 1871, through which he served, he attended the school for officers of artillery and engineers, and the Imperial Technical High School, graduating in 1872 and receiving from the emperor the commission as Officer of Ordnance. After having been promoted to first lieutenant and having served as such to the Committee of Ordnance and Arms, directly under the ministry of war, and after having served in the gunnery school for officers of artillery, he resigned his commission and came to the United States in 1881. His title of "professor" is honorary, and was obtained by Lieutenant Badt when he was still in the army, where he was instructor of mathematics and ballistics in a military academy.

After his arrival in the United States he accepted a position with the United States Electric Lighting Company, New York City, serving with this concern as superintendent of construction until November, 1888. Previous to his resignation he was sent by the company to Europe to get a general knowledge of the electrical industry there. In November, 1888, he accepted a position as superintendent with the Western Electric Company at Chicago. In October, 1889, he resigned and accepted a position with the United Edison Manufacturing Company as district engineer in Chicago. In November, 1890, he resigned and accepted a position as manager of the power and lighting department of the Thomson-Houston Company, at Chicago. When this company consolidated with the Edison Company under the name of the General Electric Company he held the same position until March, 1894, when he resigned to accept the position of general manager of the Siemens & Halske Electric Company of America. He was later on elected a director of this company and made secretary and treasurer. In September, 1897, he resigned and established his own firm, which is now doing an engineering business under the name of F. B. Badt & Company. While he was manager of the Siemens & Halske Company he engineered many of the details of the contract under which his company manufactured and furnished many large generators for the C. T. Yerkes street-railway power stations in the city of Chicago. Lieutenant Badt has served as an expert in a number of patent cases and has given testimony in suits relating to patents as well as in many other suits involving questions of electrical science. During his electrical career in the United States he has taken out a number of patents on electrical inventions, many of these pertaining to electric street railways. He has been a contributor to the technical press of the country, and is the author of a handbook series, including "The Dynamo Tenders' Handbook," "The Bell Hangers' Handbook," "Incandescent Wiring Handbook," "Electric Transmission Handbook," and others. He was married twenty-five years ago on November 2 to Elizabeth Agnes O'Donnell. His silver wedding was celebrated by a surprise party gotten up by his friends on Tuesday evening to anticipate his own arrangements. This union has been blessed with two children, both daughters, named Frances and Ernestine.

Duties in Costa Rica.

As the present customs tariff of Costa Rica does not specify the appraisal that should apply to imported electrical supplies, and it being considered unjust to apply the same duty to all such supplies, the Department of Finance and Commerce has issued a circular providing that the customs authorities shall appraise these articles under the item of the tariff which would more approximately fit each case. For instance, porcelain switches will pay the same duty as porcelain; whereas metal switches will be admitted under a different duty.

Chicago Electric Club.

The meeting of the Chicago Electric Club held on October 26 was given over to social and entertainment features, chief of which was vocal and instrumental music by an orchestra engaged for the occasion.

Electric Pumping on a Large Scale Begun in Chicago.

On the afternoon of October 29 the beginning of what promises to be an extensive application of electric power to pumping for municipal purposes in Chicago was made at the sewage pumping station at the foot of Thirty-ninth Street. One of the two large triple-expansion vertical engines that drive two screw pumps with impellers 14.75 feet in diameter used to pump lake water for sewage dilution had its cranks disconnected from the horizontal shaft and the latter was connected to an induction motor through a double-reduction train of gears.

The motor is a 750-horsepower, three-phase machine operating at 2,300 volts and sixty cycles. It is of the slip-ring type with twelve grid resistances in the rotor circuit. Its speed is 435 revolutions per minute; the gear ratio is 8.25 to 1.0 and the face of the four gears is eighteen inches each. The motor is set at the bottom of the engine pit fourteen feet below lake level. In size it seems a pigmy beside the big engines that rise to a height of thirty-five feet alongside, but it has the same power as each engine of pumping 40,000 cubic feet of water per minute.

Current is supplied to this station by 12,000-volt underground cables from the terminal station of the Sanitary District's hydroelectric transmission system. Step-down transformers reduce this to 2,300 volts for use by the motor. This pumping station is now operated by the Sanitary District and the pump just started is the first of what will likely become the exclusive electric pumping of Chicago's interrupted sewage and water for sewage dilution and probably the electric pumping of a considerable part of the city's fresh-water supply, all the electrical energy being supplied from the Sanitary District's lines.

American Mercury Lights in Hungary.

Consul-General Paul Nash, writing from Budapest, says: "That the only sales method insuring the maximum of success is to have direct representation here is illustrated by a case in point. Some time ago the exclusive European agency for a newly invented mercury-vapor lamp was given to a German firm by the American manufacturer who produced it. The greatest efforts were made by certain Hungarian firms to secure these lamps and introduce them in their market, but the German agent replied to all requests that he had more orders than he could attend to in his own country and could not be bothered with Hungary. The result was that there are now only a few of these lamps in use here, whereas had the American manufacturer seen fit to do business with some good Hungarian firm, many thousands of them would have been sold in this country."

English Quartz Lamps.

In the October number of *The Illuminating Engineer* (London) are given short accounts of two new types of quartz-tube mercury-vapor lamps made in England. The Westinghouse "Silica" lamp made by the Westinghouse Cooper Hewitt Company, of London, is a compact 3,000-candlepower unit, whose light is of a bluish-white color and very uniformly distributed over the fourteen-inch globe so as to give a light-source of low intrinsic brilliancy and high efficiency. The lamp burns very steadily and requires no feeding and only occasional cleaning. Its life is guaranteed at 1,000 hours, although the average life is about 2,000 hours.

A somewhat similar lamp is the "Quartzlite," manufactured by the British Electrical Company, of London. These lamps are made for 100 to 150 and 200 to 250-volt circuits, and are rated at 1,800 and 2,500 candlepower, respectively, in the two cases.

Telephones and Electric Lights in Palestine.

It is rumored in Jerusalem, says Consul Thomas R. Wallace, that the Turkish Department of the Telegraph (of Constantinople) intends putting in a system of telephones in all the cities of Turkey.

For lighting, until lately nothing more modern than an ordinary oil lamp has been used here, but in the last few years four electric plants have been installed. These installations consist of a storage battery and dynamo run by a petroleum motor. All the materials, even to the distilled water, are brought direct from Germany.

Exports of Copper.

Exports of copper for the week ending October 27, 6,484 tons; since the first month, 22,246 tons; last year, 21,615 tons.

Power Saving on Trolley Lines.

The British Tramways and Light Railways Association prints interesting information relating to the economy in current consumption in Continental towns as the result of the adoption of car meters, the highest saving recorded being over $100,000 a year by the Berlin company, which has 1,500 cars. There is still on the Continent some preference for the time meter, which simply shows how long current has been in use. In England the ampere-hour meter looks more likely to retain general favor. Berlin, Amsterdam, Cologne, and other cities claim that the hour meter is simpler, cheaper in first cost and maintenance, and better understood by the drivers.

Scottish Exhibition at Glasgow.

Consul J. N. McCunn has sent to Washington, D. C., copies of the prospectus of the Scottish Exhibition which will be held at Glasgow from May to October, 1911. This presents a good opportunity to give publicity to American products in Scotland. The prospectus (copies of which may be secured from the Bureau of Manufactures, Washington, D. C.) gives some interesting information regarding the scope of the undertaking and contains forms for application for space in the industrial section.

Street Railways in Australia.

The report of the Chief Commissioner of the New South Wales (Australia) Government Railways and Street Railroads for the fiscal year ended June 30, 1910, states that the street railways have shown increased profits. A total of 165.75 miles of line were open for traffic at the end of June, and there had been added to the capital expenditure $2,022,081, bringing it to $22,680,353. The total earning amounted to $5,761,860, an increase of 8.02 per cent. The percentage of expenditure to receipts was 82.96 as compared with 79.77 in 1908-9.

Modern Science Club Programme.

The Modern Science Club, of Brooklyn, N. Y., announces a lecture on "The Panama Canal," by N. B. Payne on November 15; one on "Injectors" by Frank J. O'Leary, on November 22, and one on "A Modern Hydraulic Installation," by George A. Orrok on November 29.

Electrical Equipment of a Modern Battleship.

Description of the Installation of the "North Dakota."

BY FREDERICK V. KOLB.

The United States steamship *North Dakota*, recently commissioned by the United States Navy and built by the Fore River Shipbuilding Company, of Quincy, Mass., is 518 feet in length and 85 feet in width, and has a draft of 25 feet 10.75 inches. She has a normal displacement of 20,000 tons, and contains approximately 1,950 tons of machinery. The electrical equipment, as will be noted in the following general description, fulfills the various needs as required on a vessel of this type.

There are four 300-kilowatt turbo-generators, running at 1,500 revolutions per minute. These machines supply 125-volt direct current. In the five twelve-inch turrets there are altogether ten twenty-five-horsepower motors used in connection with the hydraulic speed gears for turning, ten forty-horsepower motors for upper hoists, ten seventeen-horsepower motors for lower hoists, ten fifteen-horsepower motors for gun elevating, ten ten-horsepower motors for rammers, ten 3.5-horsepower motors for operating gun breeches, and five 1.75-horsepower motors for ventilation fans. Each of the two boat cranes has a forty-horsepower motor for hoisting and a thirty-horsepower motor for rotating. There are seven thirty-five-horsepower motors for deck winches, four four-horsepower motors for the five-inch ammunition conveyors, fourteen three-horsepower motors for the five-inch chain ammunition hoists, four three-horsepower motors for the twelve-inch powder hoists. The workshop equipment includes several electrically driven machine tools, as follows: A one-horsepower emery wheel, a three-horsepower drill, a 7.5-horsepower forty-eight-inch lathe, a two-horsepower fourteen-inch lathe, a half-horsepower sensitive drill, a 2.5-horsepower milling machine, a 1.5-horsepower shaper, and a one-horsepower portable lathe. There are seventeen 0.75-horsepower motors for operating water-tight power doors, six 1.75-horsepower, twelve three-horse-

FIG. 1.—THE WORKSHOP OF THE "NORTH DAKOTA."

power and four 6.5-horsepower motors for the ventilation fans; four four-horsepower motors for elevators, fourteen thirty-horsepower motors for forced-draft Sirocco blowers, two eighty-horsepower motors for torpedo air compressors, two three-horsepower motors for fresh-water pumps, one thirty-horsepower motor for turbine hoist, one six-horsepower motor for laundry machinery, one 0.75-horsepower motor for dishwasher, one three-horsepower motor for dough mixer, one one-horsepower motor for potato peeler, one 0.75-horsepower motor for meat chopper. Additional electrical equipment includes: one 1,200-watt and one 3,500-watt ironer for laundry, two interior communication dynamotors, two telephone motor-generators, two alternating-current danger-zone motor-generators, one gun-firing motor-generator, eight thirty-six-inch distant electric control searchlights, twenty-eight arc lamps, about 2,325 incandescent lamps in the various navy standard lighting fixtures, including one operating reflector, two diving lanterns, two night signal sets and keyboards, two truck lights and controller, a complete set of running and signal lights, captain's and man-of-war's lights, two semaphores, two peloruses, seventy one-twelfth and six one-sixth-horsepower bracket fans, twelve one-quarter-horsepower portable ventilating sets, a five-kilowatt wireless-telegraph outfit, an illuminating set with outlets for about a thousand sixteen-candlepower lamps, and an extensive system of interior communication. From the above it will be noted that there is approximately 2,400 horsepower represented in motors alone.

The current is distributed for the light and power system over two-wire circuits which feed from distribution boards located in two distribution rooms, one forward and the other aft. The total output of the plant is controlled from a generator board located in the forward distribution room. The forward distribution board is energized directly from the forward feeder panel of this generator board and the after distribution board from the after feeder panel, the current being carried through bus feeders and led through port and starboard wiring passages to the after distribution room. Either bus feeder may be used separately or both in parallel, this latter condition being that upon which the wire size was determined and the one that is used ordinarily.

In general the forward distribution board supplies all circuits forward of the midship frame and the after board all aft of the midship frame. However, all searchlights and forced-draft blowers are fed from the forward distribution room. The maximum battle load on the forward board is approximately 5,735 amperes, and on the after board approximately 2,651 amperes. One generator can carry ordinary cruising load, including a few forced-draft blowers or all searchlights, continuously for short periods. Two machines can handle the entire cruising load at high speed (all forced-draft blowers run-

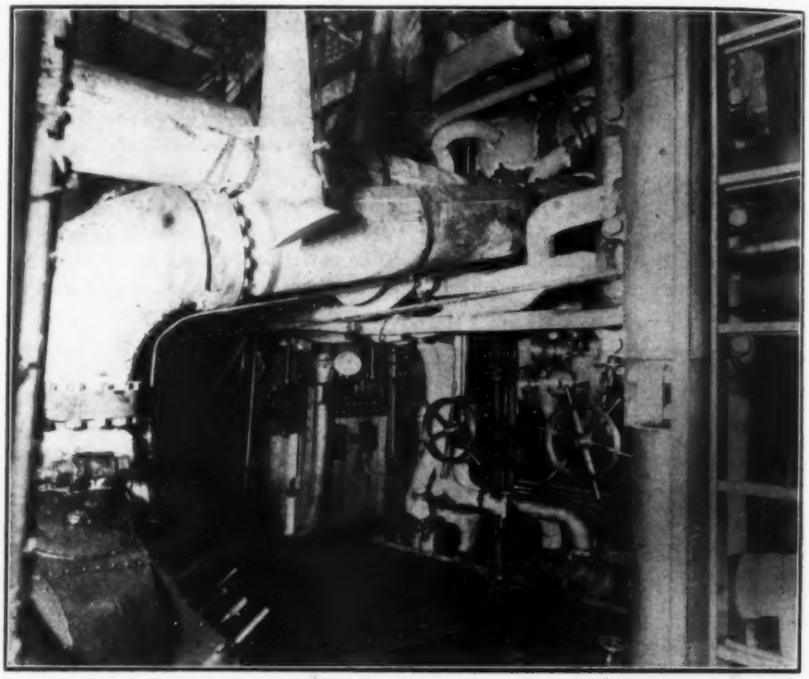


FIG. 2.—WORKING PLATFORM IN ONE OF THE ENGINE ROOMS.

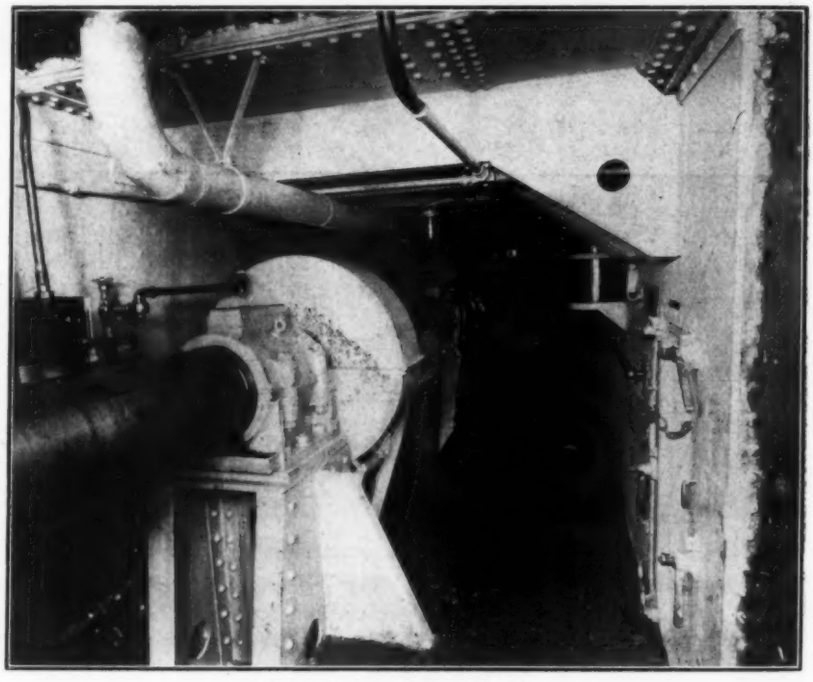


FIG. 3.—THE SHAFT ALLEY.

ning), and three can supply all the energy required under severe battle conditions.

The current supply for the entire interior communication system is controlled from the interior communication switchboard, located also in the forward distribution room, and energized directly from the forward distribution board. This interior communication board supplies 125-volt direct current to those circuits requiring the same and also to the various motor-generators located in an adjoining room, which supply the current of other voltage required for the remainder of the interior communication system.

In a central station adjoining the forward distribution room are all the switch panels controlling the telephone circuits on the ship, and also numerous other interior communication appliances. Storerooms for electrical apparatus are provided adjacent to the dynamo room and on the lower platform deck forward and near the after distribution room aft.

The generating sets located in the dynamo room consist of horizontal-type Curtis turbines with mechanically operated valves, direct-connected on the same shaft to direct-current generators. The units have two bearings, the turbine wheels being overhung. The turbines are designed to operate at 200 pounds normal steam pressure (gauge) and twenty-eight inches of vacuum. The turbine will, however, carry its full rated load when operating noncondensing or with steam pressure twenty per cent below normal with twenty-eight inches of vacuum. The normal speed of the machine is 1,500 revolutions per minute.

The steam supply to the generator turbines leads from both sides of the forward boiler room, with capacity sufficient to supply all four sets from either side. Two boilers are required to furnish the steam supply for the turbines and the dynamo steam mains are controlled by stop valves in the forward boiler room, and in the dynamo room. A separator with trap is fitted on each of the two main steam pipes, also a reducing valve.

There are two condensers, each serving two turbines, and it is possible to use atmospheric exhaust through the auxiliary exhaust line in the forward boiler room.

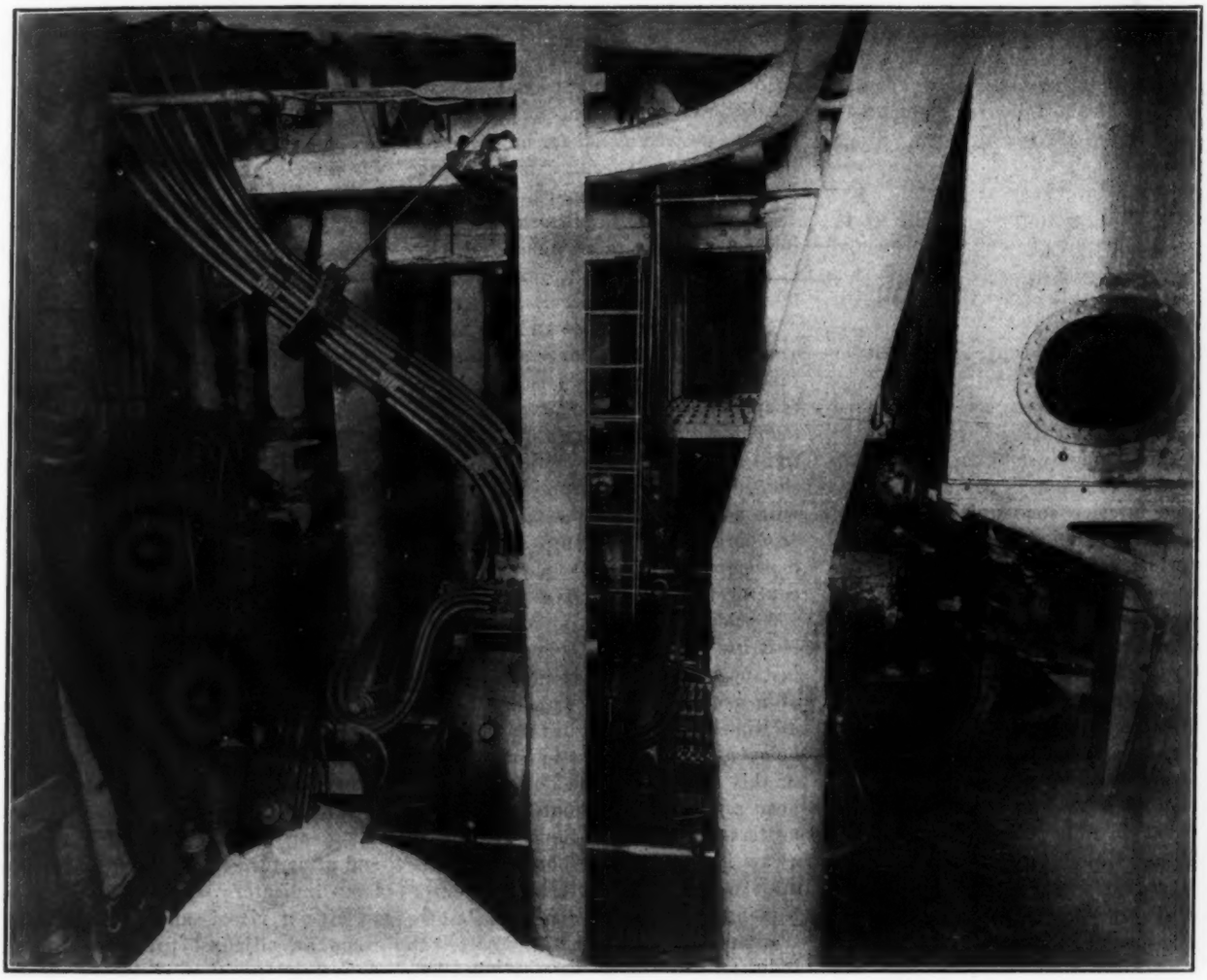


FIG. 4.—VIEW IN THE DYNAMO ROOM.

The usual dynamo-room accessories are located in this room, such as oil filters, waste tanks, log desk, clock, tool boards, etc. There is a fifteen-inch air casing at the ceiling of the dynamo room, in which the generator leads to the generator board are concealed.

There is a workshop adjacent to the dynamo room on the starboard side, with a work bench, vises, testing panel, lockers and drawers, etc. Storerooms

are also convenient for the stowage of arc lamps, portables, incandescent lamps, wire, conduit and a desk for the chief electrician.

The generator and distribution boards are made up of two-inch slate with beveled faces, finished in black enamel, and stand approximately six feet eight inches from the deck. If all the distribution panels, forward and aft, were put together in one continuous board, it would measure twenty-seven feet one inch, but on account of the small space allowed in the forward distribution room, the lighting and searchlight panels had to be installed at right angles to the rest of the board.

The lighting system is divided into two separate classes of service, battle and general lighting. Generally speaking, the circuits below the protective deck are classed as battle circuits. The battle circuits above the protective deck supply, with a few exceptions, only outlets, into which battle lanterns may plug.

The power system consists of feeders from distribution boards, supplying the various motor equipments as enumerated in the general description.

The interior communication system, as referred to in the preceding general description, is subdivided into circuits, each being given a letter of the alphabet or combination of letters as a symbol. A brief mention of each will follow, giving the instruments used and purpose for which they are installed.

All the interior communication circuits, except the turret local fire control, are fed from the interior communication board and may be considered as divided in four classes: low-voltage, such as call-bell circuits; intermediate-voltage, such as turret-signal circuits; varied low-voltage and intermediate-voltage, such as telephone circuits; and high-voltage, such as gong and telephone circuits.

Circuits *a*, *b*, *c*, *d*, are in general the call-bell system and the instruments used are push buttons, annunciators and bells, for calls required by the officers in and about their quarters. Circuits *e*, *e'*, are the voice pipe call system, one circuit for above and the other for below the protective deck, Similar apparatus is used as above for calling attention to the voice tubes. Circuits *f*, *f'*, are the fire-alarm system, using 240 thermostats in the coal bunkers, storerooms and magazines, with two ninety-six-drop annunciators in the central station, one for starboard system and one for port system, to show in which compartment there is trouble. Circuit *g* is the general-alarm gong system, consisting of five contact makers and forty-one twelve-inch vibrating gongs to give a general alarm when necessary all over the ship. Circuit *g a* is the gyro indicator system, consisting of lamp telegraph instruments in the form of transmitters and receivers, to give the angle at which the gyroscope in the torpedo is to be set before firing from the tube. Circuit *h* is the anchor-handling gong system, with ordinary push button and gongs, used to give the desired signal for handling the ship's anchors. Circuit *i'* is the engine and fire-room telephone calling system, using ordinary push buttons, bells, etc., for calling attention to these telephones. Circuits *j* 100, *j* 101, are the telephone talking circuits, starboard and port, for the engine and fire rooms. Ten watertight telephones are used for this system. Circuit *i j* is the general telephone system, using two types of telephones, watertight and nonwatertight, for general communication about the ship. Sixty telephones all connect with a central switchboard tended by an operator, and five conversations can be carried on at one time. The fire-control telephone system consists of 100 telephones, grouped on numerous circuits, *j a* to *j w*. This gives in one instance an officer above deck in charge of a group of guns communication at all times with the gunners stationed below at the guns. The telephones used in this system are the double-receiver head set, with or without breast transmitters, and when not in use are stowed away in composition boxes, near the outlets. Circuit *k* is the shaft revolution-indicator system and consists of a transmitter on each shaft connected to indicators at the various steering stations, giving the revolutions of the shafts. Circuit *l* is the steering telegraph system, consisting of transmitters and receivers for giving the desired steering orders from bridge to steering engine room. Circuits *m*, *m'*, are the starboard and port engine-room-telegraph systems, using transmitters and receivers which repeat back, to give the desired engine orders from bridge to engine room. Circuit *n* is the helm-angle indicator system, having a contact maker at the rudder post, and indicators at steering stations, giving the position of the rudder by degrees to the left or right of the center. The above are styled lamp-telegraph systems. Circuit *o* is the range, deflection and battle-order telegraph system, and is one designed and built by the Sub-Target Gun Company, of Boston, Mass. It serves the twelve-inch turret guns only and operates to transmit fire-control information from either of two substations below decks to each turret. Circuit *p* is the broadside ammunition-hoist telegraph system, consisting of transmitters and indicators, lamp type, for giving the necessary orders for the hoists. Circuits *p a*, *p a'*, *p a''*, *p a'''*, comprise the gun-firing system. There is one circuit each for the forward and aft turrets and one each for the starboard and port broadside guns. These supply current to the guns for firing them electrically. Circuit *q* is the warning signal system and consists of three contact makers and thirty-three horns of Holtzer-Cabot Company's design to give warning to the various parts of the ship just before the watertight doors are to be closed. Circuit *r* is the turret local-fire control, consisting of a switch and indicator lamps between turret officer and guns to give information as to which gun will be fired next. Circuit *s* is the power-door emergency signal system, which consists of a contact maker at each door and indicator lamp at control station, to give information when the seventeen electrically operated power doors are closed. Circuit *t* is the torpedo-firing system, consisting of a contact maker or keys, at director stations, and a solenoid at each torpedo tube, to fire the torpedoes electrically. Circuits *t a*, *t a'*, are the turret danger-zone system for forward and after turrets. Contact makers and lamp indicators with howlers are used to give a visual and audible signal when an adjacent turret comes in a dangerous position if the guns were fired in either turret. Circuits *t b*, *t b'*, are the turret telltale system for forward and after turrets and the instruments used consist of contact makers and electromagnet indicators, giving the position of one turret in relation to its adjacent turret. Circuit *u* is the cease-firing gong system, consisting of two contact makers and twenty-two ten-inch vibrating gongs giving a signal to stop firing the guns. Circuits *v*, *v'*, are the broadside gun and turret salvo systems, using push buttons, bells and buzzers. These systems give a signal from a station above

deck to stand by, with the bells, and a signal to fire all guns simultaneously with the buzzers which are attached to each gunner's breast. Circuit *w* is the electric-whistle operator system, which can be controlled manually or automatically. It comprises a clockwork mechanism and an electromagnetic valve. This allows blowing the main whistle electrically at will, or, when it is set for automatic operation, the clockwork mechanism blows it once a minute. This whistle is also operated mechanically. Circuit *x* is the oil-fuel-tank signal system, consisting of eight contact makers at the oil tanks, and two annunciators at the filling station, to give warning when the tanks are full. Circuit *y* is the electric log indicator system, consisting of a contact maker on the side of ship in connection with the taffrail log in the water, transmitting the speed in knots as shown by the indicator located in the chart house. Circuit *z* is the boiler time-firing system, and consists of a transmitter in the engine room with eight lamp-and-bell indicators in the boiler rooms indicating the next fire-box of the boiler to be fired. The transmitter is set by the engineer to fire at regular intervals of from forty seconds to ten minutes, as may be desired.

By the above general description one obtains only an outline of what is meant by the electrical equipment on this vessel. There is much detail connected with what has been mentioned in regard to installing the various systems of light, power and interior communication, the design of the various apparatus and appliances used in carrying out the navy standard methods.

Fig. 1 shows the workshop with the electric motor-driven machines throughout, where extensive repairs can be made on board.

Fig. 2 shows the working platform in one of the engine rooms just forward of the turbine, illustrating the arrangement of electrical instruments, such as voice pipes, telephones, engine telegraph receivers, etc.

Fig. 3 shows the shaft alley where the torsiometer is located; the electric shaft-revolution contact maker is seen with the worm pinion on projected shaft ready to mesh into a worm band on the main turbine shaft not installed at the time this photo was taken. Also note the electric light fixtures and appliances.

Fig. 4 shows a view in the dynamo room illustrating the crowded condition, where four 300-kilowatt turbo-generating sets are installed in a space 20 feet by 42 feet. Also note the arrangement of cables.

Fig. 5 shows the electrically operated boat cranes with controller platform, also two of the eight searchlights installed.

FIG. 5.—ELECTRICALLY OPERATED BOAT CRANE.

New Wireless Station in Brazil.

The Brazilian Government has erected a wireless telegraph station on the beach at Amaralina, close to the village of Rio Vermelho, which is about two miles north of the lighthouse that stands at the entrance of the harbor at Bahia.

The new station is equipped with the Telefunken system and has a guaranteed range of 400 miles, although its actual working range is far greater, as shown by the fact that during the trials recently conducted, communication was readily established with the wireless station near Rio de Janeiro (about 730 miles) and with a vessel more than 1,000 miles distant. Messages are relayed between Amaralina and Bahia by an overland telegraph line.

The principal features of the station, which was installed by a German firm, are as follows: Height of mast, 197 feet; primary energy, 20 amperes and 220 volts; number of rotations of generator per minute, 1,500; high tension of transformer, 15,000 to 20,000 volts; length of waves used, 600, 1,000, and 1,600 meters (656.1, 1,093.6, and 1,749.7 yards, respectively).

Cleveland Smoker.

The Electrical League of Cleveland will give a smoker on the evening of November 19 in the Auditorium of the National Electric Lamp Association, Hough Avenue and East Forty-fifth Street.

ILLINOIS STATE ELECTRIC ASSOCIATION.

ANNUAL CONVENTION AT ROCK ISLAND.

The convention of the Illinois State Electric Association that was held at Rock Island, Ill., on October 25, 26 and 27, was in practically every way the most successful that the Association has ever held. The attendance, the high quality of the papers and the interest taken in every feature of the convention have not been excelled in the history of the organization. There were 147 central-station men present and at all the meetings the attendance was good and keen interest was taken in the discussion of the papers presented.

Of supply men there were registered 115; through their organization, the Illinois Electrical Exhibitors' Association, they co-operated heartily in the entertainment and commercial features of the convention and made a very fine exhibition of the most up-to-date electrical devices that attracted well deserved attention.

The convention was held in what is called the Service Building, in which the People's Power Company has offices on the first floor. The whole sixth floor was given over to the convention and the exhibits, with a very good exhibit of the Power Company on the first floor, including meters and various household appliances in operation. The Company aided materially in the success of the convention and its interest in the welfare of the delegates was appreciated by all.

On Tuesday evening the convention programme opened with a "get together" smoker and vaudeville entertainment given by the supply men to the central-station delegates. This was a very enjoyable affair.

The convention proper was opened by President E. W. Smith on Wednesday morning. Reports from standing committees were called for. The Committee on Membership reported eighteen new companies wishing to join the Association all of which were accepted.

The first paper presented before the convention was entitled "Sign and Window Lighting," by E. W. Osborn, advertising manager of the Rockford Electric Company.

SIGN AND WINDOW LIGHTING.

The successful merchants, said Mr. Osborn in his paper, are the ones who know how to use the drawing qualities of the electric light and are using it liberally in store, window and sign illumination. The central-station company should lead the way by making an attractive window display itself. Sign and window lighting should be sold strictly as advertising, as it is used to attract attention to what is displayed in the store. Separate bills should be rendered for this service and the store lighting not combined with it. A good solicitor can easily show a merchant who is paying a high rental that the earning value of his location would be enhanced by well lighted windows and attractive electric signs. Such advertising produces far greater results than any other form for the money expended. The flat rate is best for this service. A separate circuit should provide for it and be controlled by the company. Light should be furnished from dusk to midnight, and on this basis will net about six cents per kilowatt-hour where the maximum meter charge is ten to fifteen cents per unit. This requires about 2,400 hours per year and will earn $144 per kilowatt per year. The introduction of the low-voltage tungsten sign lamp has increased this business materially.

In the discussion of this paper considerable attention was given to methods of charging for this service. One company makes a rate such that it nets about six cents per kilowatt-hour. Another company furnishes window-lighting service at the rate of one watt per month, where tungsten lamps are employed and renewals are furnished at cost. The lights are on a separate circuit controlled by the company's inspectors. The service is from dusk till ten p. m. five nights a week, and until midnight on Saturday. This service nets about 6.3 cents per kilowatt-hour.

Regarding the question of renewal of the lamps, some contended that it was better to make the rate high enough to cover such renewals as otherwise the merchant is apt to neglect the window lights, allowing them to get blackened and the shades to become soiled and out of adjustment, so that poor results are given.

One company has been quite successful in lighting the exteriors of stores, eight-candlepower twelve-volt tungsten lamps being mounted twelve feet from the sidewalk and about four feet apart. These furnish enough light to read a newspaper anywhere on the sidewalk. The charge is $1.00 per month for each store-front so illuminated; this includes renewals and nets the company about twenty-two cents per kilowatt-hour. Only a few weeks ago this company had closed contracts for 112 store-fronts, the average being four-and-one-half lamps to each store-front.

A paper on the "Radical Tendency in Rates" was then presented by J. S. Maltman, new-business manager of the Kankakee Gas & Electric Company.

THE RADICAL TENDENCY IN RATES.

Mr. Maltman called attention in his paper to the fact that the relations between a central-station company and the public are not as harmonious as between an ordinary retail store and the public. If the public could understand the rates of a central-station company as well as those of a retail store it would undoubtedly be conducive to a better feeling. Therefore, he made a very strong plea for simplicity in rates. It is impossible to get the exact cost of service to each customer; it cannot even be approximated. He questioned the value of using what he regards as the elaborate system of adding to the cost of service the energy charge. The highly technical rate spoils the opportunity for securing new business in a small community. No other business uses a complicated system of rates. Merchants do not charge for the service they give but for the commodities they sell. The public wants to do business in a way it understands or thinks it understands. The recent talk about what would happen to central-station revenues if a one-tenth-watt-per-candle lamp should be introduced is all a bugaboo. It would in fact be the greatest revenue producer that the central station ever secured. It would open an enormous field for electric lighting, and, therefore, for other electrical appliances. Most consumers seem to be willing to pay a certain amount for light. If this amount is exceeded they complain. If the bills are under this amount they use current more liberally. Rates should be established as a business proposition and not as an engineering proposition. By catering to the public the best results are secured for the stockholders.

This paper provoked a very lively discussion as to the best method of charging. Many rates were quoted and it was the general opinion that no company can use the readiness-to-serve charge for residence lighting, but that it was a good rate to use in commercial service. Some kind of control for residence load is desirable. For instance, a flat rate can be made for say 150 watts as a maximum, and an excess-load indicator used to flicker the lamps when this is exceeded, thus warning the owner that he was going above the guaranteed maximum. It was the consensus of opinion that it is the duty of every company to try to familiarize the public with its system of rates, and that the simpler these rates are the easier the public will understand them and be satisfied with them. A double-rate system is desirable on account of helping the use of appliances that are used at off-peak times. With a straight rate these are harder to introduce.

M. G. Linn, of Bloomington, stated that his company had put into effect a double rate on the first of the year. These rates are ten and five cents per kilowatt-hour, the former being based on thirty hours' use every month of the connected load. Another company bases its maximum at sixty per cent of the connected load. Others assume this

as being only twenty-five per cent of the connected load. Another company bases its maximum demand on the plan of allowing one sixteen-candlepower lamp to each room, regardless of the number of lamps actually installed therein, and two hours daily use of this lamp is assumed in establishing the high rate. All these more or less arbitrary assumptions of the maximum demand are made use of to avoid the large cost of installation of maximum-demand meters which does not seem to be justified in residence work.

A paper on "Electric Shows in the Smaller Cities" was then presented by J. E. Johnson, general superintendent of the Danville Railway & Light Company.

ELECTRIC SHOWS IN SMALL CITIES.

Electric shows are a form of advertising, and like all forms of advertising are very intangible in their results. Every central-station man who has attended one of the large electrical shows held in Chicago, New York, etc., is impressed with the enormous benefit that must result therefrom to the local central-station companies. Naturally, therefore, he would like to have such a show in his own community. Mr. Johnson then explained at some length how an electric show had been held in his city last summer. Local supply men were appealed to and a number of manufacturers of both electric and gas appliances. These furnished exhibits and even demonstrated them in some instances. An exhibit of each class of appliances that is ordinarily on exhibition at the large shows was secured. A room 50 by 150 feet that happened to be vacant was rented and the show given for one week. Some attention was given to providing attractive decorations and artificial foliage was applied liberally to produce a sort of garden effect. Columns were erected to mark the different booths at the sides of the room and tungsten lamps were liberally used to light up the premises. The back of the two show windows was papered and one of these was fitted up as a dining room with an array of electric table appliances; attractive fixtures were also provided. The other window was arranged as a model gas kitchen, since the company also supplies gas. A great variety of interesting exhibits were secured in the line of electrically-driven machines for both household and light industrial use. The local telephone and telegraph companies furnished exhibits, a wireless outfit was also secured, and on the whole a very attractive and interesting display was made in every booth. The greater part of the city's 35,000 inhabitants visited the show during the week it was open because no admission was charged. The company's solicitors and a number of its office force were present both afternoons and evenings to explain the uses of the different articles and to distribute folders, booklets, etc. The show cost the company altogether a little over $300, although the public got the impression that it cost a great deal more. This investment was undoubtedly a very profitable one, because not only were a large number of appliances sold and contracts secured, but a forcible impression was left on the minds of the entire community as to what things were desirable in the electrical line. Mr. Johnson thinks that a show of this kind given every two or three years will well repay itself.

President Smith, of Kewanee, said that an electric show had been held in his city about two years ago. At that time it did not seem as if much good had been done, but now it is becoming more and more evident that it had been a great benefit to his company. The returns from such a show are apt to be indirect and difficult to estimate.

Mr. Bass, of Farmington, said that when the day circuit was started in his community the company equipped what it called the "house electrical" in a store, one side of which was fitted up with rooms about ten feet square. In these various rooms were shown all kinds of appliances and a variety of lighting fixtures. The result of this electric show was that there are now in service over 300 electric flatirons, and the demand for these is as good as it ever has been. Another speaker told how his company had made an exhibit at a pure-food show given by the merchants of his city, and as a result of which many heating appliances were placed on the company's circuits.

The afternoon session on Wednesday was opened by President Smith introducing L. D. Mathes, of Dubuque, Iowa, past president of the Iowa Electrical Association. Mr. Mathes made a brief but very interesting speech, testifying to his great interest in the proceedings of the Illinois Association.

The first paper presented at this session was by T. P. Pinckard, new business manager of the Peoria Gas & Electric Company. This paper was entitled "Promoting New Business." Directly at its conclusion Max Heiliger, assistant manager of the Rockford Electric Company, read a paper on "How to Get New Business."

PROMOTING NEW BUSINESS.

In this paper Mr. Pinckard made strong objection to the cumbersomeness of many new-business departments. Many of the enthusiasts along this line with all their card indexes and such methods seem intent, he said, on making a big job for detail out of a little one and a little job for a good man out of a big one. In a moderately small community there is no need for elaboration. He protested against another popular fancy namely, that of putting out on trial flatirons, toasters, etc. It was necessary to do this when they were introduced for the first time, but it is absurd, he thinks, to continue this practice when in some instances fifty-eight per cent of the devices are returned in a much depreciated condition for which the company must stand the entire loss. There has been a great impetus to the commercial end of the business during the last five years, but in many instances the pendulum has swung too far. There should be a limit to the extent to which central-station men should go in order to secure business. After all that has been said about new-business methods it is undoubtedly true that personal solicitation produces the greatest good. Appliances should not be sold too close to cost. A good profit should be made on all goods that are sold, as well as the current supplied. The increased current consumption will not suffer because of such a policy.

HOW TO GET NEW BUSINESS.

Mr. Heiliger called attention to five cardinal points that must be considered in all campaigns for new business. These are: Advertising, personal solicitation, courtesy, enthusiasm and service. Newspaper advertising is the most important and gives the greatest returns for the amount expended, if it is handled in a judicious manner. The headlines must be very carefully drawn up. Personal letters or their fac-similes are excellent mediums. It is desirable to inclose manufacturers' circulars when bills, receipts and other mail are sent out from the office. Personal solicitation is absolutely essential to the success of any new-business department. If the company is not large enough to employ one or more solicitors, then the manager or superintendent should devote a definite amount of time each day to this work. Nothing is so effective in securing business as personal contact with the prospect, and when combined with judicious advertising it makes an almost infallible combination. Courtesy on the part of every employee is of vital importance in securing new business and retaining the old. Enthusiasm is a necessary quality on the part of every commercial man. It enables the solicitor to overcome the apathy of a prospect and to overcome the wiles of his competitors. Good service is absolutely essential. This means prompt attention to complaints, prompt repairs to defective lights or appliances, and in fact prompt attention to everything affecting the relations of consumer and company. A friendly call on old consumers once in a while is of value in cultivating their good will.

These two papers were discussed together, and it was indeed a lively discussion. The question came up first of getting customers to use current-consuming devices, especially electric flatirons. One company that had made a campaign along these lines stated that it cost about $2.00 to sell each iron, this including the demonstration cost and also the loss due to selling the irons at a little less than cost.

Mr. Cushing, of Chicago, said that if a company could afford to furnish free lamp renewals it should certainly be able to put out free irons in consideration of the much greater current consumption of the latter. Moreover, the use of an electric iron often leads to further use of electric current for other appliances, and is in many instances an entering wedge to secure the lighting of the house. Another speaker stated that of the irons that were sent out by his company seventy-five to eighty per cent were kept. In some places as high as ninety-eight per cent has been recorded. A great value of pushing the

irons as the first of household appliances was that if a lady becomes satisfied with the iron she will tell her neighbors, and therefore the irons practically sell themselves and lead to the use of electric current for many other purposes.

The question of residence wiring was brought up, and the practice of the Commonwealth Edison Company of Chicago was cited in this connection. Residences are wired at cost and the customer is permitted to pay for this in twenty-four monthly payments. This practice is followed in the wiring of old houses, as it is supposed that all new buildings will naturally be wired, and a watch is kept that they are wired in a practical manner. The company gives a flatiron free with a contract for twenty-four payment wiring. The company is not particular as to the time of the trial of an iron, and it has found that ninety per cent of all irons put out on trial have been kept. The company has recently advertised that it will furnish free renewals of electric irons regardless of what is the matter with them, even if only a cord is broken. It is a good idea to have the solicitors call on old customers to see if there is not something that can be done for them.

At this time the regular programme was departed from and the president called for a report from the Committee on Rates. This committee was appointed at the last meeting and its chairman, R. S. Wallace, of Peoria, read the report.

REPORT OF COMMITTEE ON RATES.

The committee made a careful investigation of the various systems of rates that are in vogue. It defined the ideal rate as one that is at the same time equitable, practicable and legal. The report is a preliminary one and covers the matter in a general way. The most customary systems of rates are (1) flat rate, (2) uniform meter rate, (3) sliding scale rate (4) differential rate. The last is nearly always dependent upon some method of determining the maximum demand of the consumer, this being determined in many instances by an indicator installed on the premises or by some more or less arbitrary assumptions. The readiness-to-serve system is one of these differential methods of charging. Each of these systems was described in a general way and to better illustrate the differential rate the figures were appended for a station having a capacity of 400 kilowatts in a town of 10,000 inhabitants. A bulletin of some of the prevailing systems of light and power rates in the state was also appended, and a bibliography on the subject of rates.

The report of the Committee was accepted and the Committee was asked to continue to serve for two more years.

Frank J. Baker, of Chicago, called attention to the system of classified accounts that has been prepared by the Accounting Committee of the National Electric Light Association. He urged that this was a very good thing for all companies to adopt, especially as many small companies do not have a fair rate, that is, one that was fair to themselves, and are unaware of that fact. The Commonwealth Edison Company, of Chicago, was seriously considering adopting this system as outlined by the National Association's Committee. It was possible that in the state of Illinois there might soon be created a public service commission and the immediate adoption of a uniform system of accounting would be a good thing for all concerned, as then the commission would be better able to tell in just what condition the companies were and what they were doing. As the National Electric Light Association's system had the approval of the New York Public Service Commission it might very appropriately be adopted by the future Illinois commission. The fact was also brought out that the cost for making the change of accounting to that proposed by the National Association would not be great. In many instances this cost would not be more than $25. For completeness of analyzing the income and expenses this system could not be improved on.

L. D. Mathes, past-president of the Iowa Electrical Association, was called upon at this time and gave a very interesting talk upon the papers that had been presented. He stated that excessive use of the card-index idea was a hindrance to a new-business department, and that all the business of this department should be conducted upon dignified lines and not upon the circus method of securing business. The custom of sending circulars with letters was a good one, and a personal letter inclosed with the advertising matter and calling attention to the goods referred to, is very effective.

J. R. Cravath, of Chicago, was called upon to say something regarding the system of indirect lighting as installed in the new Blackstone Hotel in Chicago. He gave a short history of the progress of indirect lighting from the first attempts to use this system, but which were not a success because the proper reflectors had not been developed and the lamps used were not efficient. Now, however, with tungsten lamps and properly designed reflectors good results are obtained and an almost shadowless illumination is secured.

O. C. Macy, superintendent of the Alton Gas & Electric Company, then read his paper on "New Business Ideas."

In the discussion of this paper a number of speakers contended that it was better to tell a customer that the cost of his service is a dollar a day than to state it will be thirty dollars a month.

The session on Thursday morning was opened by the reading of a paper on "Des Moines Plan of Meter Reading" by P. B. Sawyer, general manager of the Des Moines Electric Company.

DES MOINES PLAN OF METER READING.

Mr. Sawyer's paper gives a review of the system adopted by the Des Moines Electric Company of reading meters and billing accounts. Formerly it was customary to read the meters as nearly as possible on the last day of the month and a cash discount was allowed for payment by the middle of the following month. This created great congestion at the close of the month and around the middle of the month. Therefore, it was decided to divide the city into twenty-five districts corresponding to the working days of a month. One meter reader takes care of all of the 3,000 or more meters in service. A book with a loose leaf for each consumer is made up for each district and he covers a district every day. The bills are sent out the following day and they are payable with the discount within fifteen days. This system has been a great relief to the business department and had resulted in a saving of about $170 in the reading of meters alone by the end of the first year. The errors in reading were reduced to almost nothing. The errors in figuring bills likewise, as the latter work is entrusted to a proficient clerk. Complaints are investigated thoroughly, and do not become known to the great mass of consumers as was formerly the case when they congregated in the office around the fifteenth of the month.

Various methods of meter reading were considered in the discussion. Some central-station men get good results with the postal card scheme of notifying those that are missed at the regular reading. Others make an approximate reading, and render a bill for that, and at the following month the actual reading is taken and the bill corrected accordingly. This plan was objected to by some companies, because it may lead to considerable complaint from excess bills. Some companies make the minimum charge for the month missed. One company calls up the customer and asks him to take the reading; this is regarded as a very good plan, as the customer becomes accustomed to reading his meter, and has more faith in the accuracy of the bill.

Dr. Ernst J. Berg, professor of electrical engineering at the University of Illinois, was then called upon to present his paper on "Hunting of Syn-

chronous Apparatus." Instead of doing so, however, he stated that he would not read his paper but would call attention to it, and urged the members to read it at leisure. He then referred to some of his early experiences while with the General Electric Company. In the early days of parallel operation of alterating-current generators many amusing incidents took place. He called attention to the need of having all pulleys of exactly the same diameter where generators are driven from a single line-shaft, otherwise a uniform speed cannot be attained. It is important to see that there is not too much resistance in the cables connecting the generators and busbars. The air gap is an important factor in successful parallel operation. With steam-driven alternators the engine governors must be put up tight with no loose joints; even the difference between a joint with oil in it and a dry joint will tend to make considerable trouble. Some trouble is also noted in operating turbo-generators which have little self induction; this can be remedied by installing some inductance coils in the leads. Sometimes the addition of a flywheel effectively cures the hunting troubles by making the natural periods of the generators correspond.

C. W. Lee, secretary and treasurer of the C. W. Lee Company of New York, read a paper on "Publicity and Public Policy."

PUBLICITY AND PUBLIC DUTY.

Mr. Lee's paper is a forceful presentation of the advantages of taking the public into the confidence of any public utility corporation. The average public service company did not realize until about ten years ago what its exact relationship was to the community. There are relatively few communities that have due regard for the rights of public utility corporations or a proper conception of their problems. The public has been inclined to view their acts with suspicion, and public officials and local bosses have exploited this feeling as a political expedient. The companies have been forced to adopt defensive methods which, while unethical, were necessary in order to protect vested rights. The sooner the attitude of the public is understood the sooner will the age of economic reason be reached. Corporations must in the future take their cases directly to the people instead of to the politicians. Public sentiment must be utilized to secure legislative justice. There is not a community so lacking in the sense of fair play that it cannot be made to see public utility problems in their true light if given an opportunity to do so. This has been shown by many instances of utilities that have adopted the policy of publicity. Mr. Lee cited the cases of the companies in Maysville, Ky., Kewanee, Ill., Louisville, Ky., Haverhill, Mass., and Buffalo, N. Y. If the company's case is presented in a skillful and convincing manner, after an analytical study of local conditions and sentiment has been made, then there need be no fear as to the outcome of the campaign. If this policy had been followed in the past probably ninety per cent of the municipal and competing plants would not have been built and the same proportion of the present unjust state and city laws would not have been enacted. In Mr. Lee's paper several examples were given of the advertising copy which was used in some of these publicity campaigns.

Mr. Crawford, of the Iowa Electrical Association, was present and was called upon to enter into the discussion of this paper. He stated that the conditions in Iowa are quite similar to those in Illinois, but that all franchises in Iowa have to be voted upon by the people. Therefore it is more important that the sentiment of the public should be favorable to a company. The electric business has been developing very rapidly, and too little attention has been paid to the securing of the good will of the public and the making of concessions to it. In fact, the rights of the public have not been taken into consideration very much. Now is the time to try to interest the public financially and to make the public service business a good investment. This not only helps the company in securing the good will of the public, but makes more people directly interested in the welfare of the company, and therefore makes it easier to secure contracts and franchises.

At this point it was decided to dispense with the afternoon session, and to conclude the business of the convention by going into the executive session for the election of officers. The Nominating Committee reported, and the convention unanimously elected the following for officers for the ensuing year:

W. G. Austin, of Effingham, president.

H. A. Foster, of Fairbury, first vice-president.

J. J. Frey, Hillsboro, second vice-president.

F. H. Golding, Rockford, third vice-president.

E. MacDonald, Lincoln, fourth vice-president.

F. W. Reimers, Rock Island, treasurer.

H. E. Chubbuck, Peoria, secretary.

C. A. Willoughby, Peoria, assistant secretary.

Executive Committee: Wm. B. McKinley, Champaign; R. S. Wallace, Peoria; Frank J. Baker, Chicago; F. M. Sinsabaugh, Carrollton; E. W. Smith, Kewanee.

EXHIBITS.

A feature that is becoming very popular with the annual conventions of the Illinois State Electric Association is the exhibition of the latest electrical devices by the manufacturers and supply men. The exhibits were as follows:

The Franks Manufacturing Company, of Rock Island, had an exhibit of the new portables it is putting on the market.

Another local exhibitor was the Emeis Company, of Davenport, which is building a magneto for ignition work that is large enough to carry lights for car or boat use.

The Automatic Washer Company, of Newton, Ia., had one of its washing machines on display.

The Dearborn Drug and Chemical Works, of Chicago, had a number of representatives at the convention to explain its system of treatment for boiler-feed waters.

Fairbanks, Morse & Company made a display of alternating-current motors and starters for the same.

The Fort Wayne Electric Works, Ft. Wayne, Ind., exhibited its line of watt-hour meters, single and polyphase motors, the "Compensenarc" for moving-picture work, fan motors, bell-ringing transformers, and meters for calibration.

The H. W. Johns-Manville Company made an exhibition of many electrical goods it handles, including Linolite lamps of both carbon and tungsten types, tape, high-tension insulators, and service cut-outs.

The Simplex Electric Heating Company's devices were much in evidence, as there shown was a complete line of the many appliances made by the company.

The Western Electric Company exhibited a line of tungsten fixtures and the Hawthorn vibrator.

The Hughes Electric Company, of Chicago, had a booth to show its line of electric stoves and ranges.

The Westinghouse Electric and Manufacturing Company had a large exhibit, including many sizes of motors for various purposes, instruments and lamps. Special attention was called to the new type of wire tungstens of which the new 500-watt size was shown.

The Wagner Electric Manufacturing Company, of St. Louis, displayed an assortment of motors for alternating current.

The Holophane Company exhibited a large number of prismatic and steel shades and reflectors.

The General Electric Company had a corps of representatives to explain the various products of the company. A full line of electric cooking devices were on exhibition, from the new complete range to toasters, the new art craft chafing dishes and percolators. Small motors were shown with hand drills.

The Electric Appliance Company, of Chicago, and the Sangamo Electric Company, of Springfield, Ill., shared a booth in exhibiting the series control for tungsten street lighting and Sangamo meters.

The Valentine Clark Company had some sections of poles that had been treated with the "C. A." wood preservative.

The Federal Electric Company showed the new Willis "Straight Line" watt-hour meter, suction sweeper and Federal sign and lighting specialties.

The Electrical Machinery and Construction Company, of Rock Island, displayed fixtures and a washing machine with wringer electrically operated.

The Jandus Electric Company had on exhibition the Daniels boulevard lighting post for tungsten lamps and for arcs.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring

ELEMENTS OF POWER-STATION DESIGN—X.

SWITCHBOARD DESIGN.—I.

BY W. B. GUMP.

The previous chapter dealt with the fundamentals of wiring connections, as related to the preliminary part of the electrical system. Superimposed upon this general layout are the details such as switch control, feeder circuits, instrument connections, and finally the design of suitably arranged structures for containing these elements. Some of the more important of these details are to be treated within the scope of the following discussion.

Switch Control.—There are two general types of switch control: (*a*) Manually operated; (*b*) remote control.

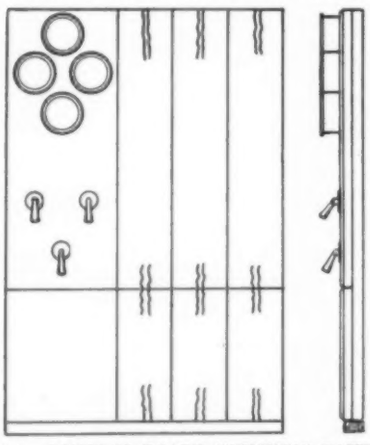


FIG 1.—CONTROL BOARD, VERTICAL PANEL TYPE.

The treatment here will be confined especially to the latter class.

There are several methods employed in remote-control operation, such as: (*a*) Electrical; (*b*) compressed air; (*c*) hydraulic.

The larger power stations almost invariably use the first method, that of electrical control. Its chief advantages over either of the other methods are: (*a*) Absence of complex piping with air-tight joints; (*b*) elimination of a continuously operated compressor, or other auxiliary; (*c*) elimination of more or less troublesome valves.

The electrical system of control is more flexible, since the wiring between the main switches, controlling source, and source of supply can be made to conform more conveniently to the desired location of apparatus than is usually the case with piping. The present description will refer only to electrical control.

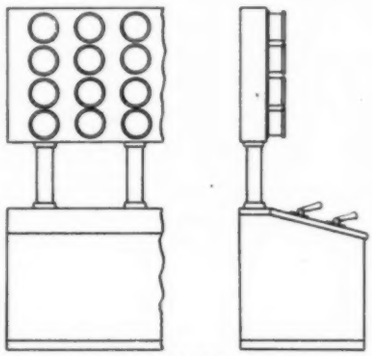


FIG. 3.—BENCH BOARD, OR CONTROL DESK.

There are two types of electrically operated switches: (*a*) Solenoid type; (*b*) motor-operated.

The main advantage of the solenoid type over the motor-operated type is that there are no moving parts to the solenoid except the plunger. With the latter type the motor demands more attention and is more likely to give trouble than a solenoid. In either type there is an appreciable time element between the closing of the control switch and the closing of the main switch. This time element is due to a certain extent to the effect of self-induction, but to a much greater extent to the inertia of the heavy moving parts. Thus, in synchronizing, an allowance should be made for the closing of the switch. This applies particularly to frequencies exceeding twenty-five cycles.

Control Boards.—There are three general types of control boards: (*a*) Vertical panel type; (*b*) pedestal type; (*c*) bench board, or control desk.

The types mentioned are illustrated in Figs. 1, 2 and 3. As to a choice between these types it may be said that much depends upon the space available for the switchboard, and the general arrangement of the plant. Where the control is separated from the generating room, either in an adjoining room or separate building, the pedestal type is generally a wise choice, especially where the unit system is employed; that is, where the generator is a unit with a bank of transformers and transmission line. In this arrangement each pedestal corresponds to an instrument stand for a given unit, and simplifies operation as compared to a continuous panel or bench control.

The bench board or control desk is

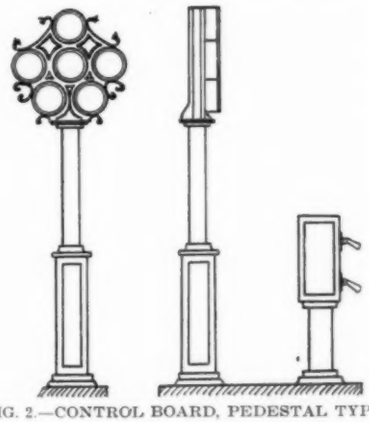


FIG. 2.—CONTROL BOARD, PEDESTAL TYPE.

suited to plants where it is feasible to have a high gallery overlooking the generators. In such cases the control bench and instrument stand are combined, and can usually be made quite compact. One distinct advantage of both the desk and pedestal types is that the view from in front or behind the board is not cut off, since the instruments may all be placed above, allowing an open space between them and the desk.

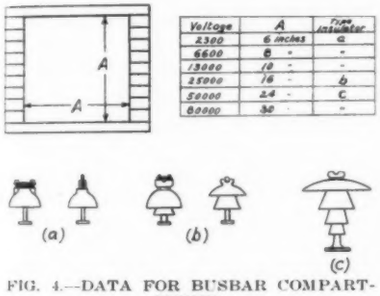
Where floor space is a very important item, the panel type is to be pre-

ferred to the bench board. Even on galleries this type will often permit a very satisfactory arrangement, although it is not as typical as the pedestal or desk control board.

Material and Construction.—For low voltage, up to 600 or 700 volts, slate panels may be used. Above the latter voltage, marble is necessary. Since control boards require only the relay current they are generally constructed of slate with a black enamel finish. Pedestals are constructed of cast iron or may be combined with slate or marble. The upper portion is sometimes ornamented with some form of iron scroll.

In the bench-board type the slate panels are supported by angle iron or pipe framework, and are in some cases left open on the rear side for inspection.

Where high-tension wires, cables or busbars are run, they should be separ-



Voltage	A	Type insulator
2300	6 inches	a
6600	8 "	"
13000	10 "	"
25000	16 "	b
50000	24 "	c
60000	30 "	"

FIG. 4.—DATA FOR BUSBAR COMPARTMENTS.

ated between barriers constructed of concrete, soapstone, asbestos or some other similar material. Concrete apartments are generally to be preferred to any other substance, since concrete is fireproof. Soapstone may be used in portions of the structure where extra high insulation is more desirable than fireproofing. As a matter of fact high insulation will prevent fire unless the busbar, switch blade or cable in question becomes overheated through some outside source. Such a condition is very remote. Due to the high cost of soapstone it is generally to be avoided when some cheaper materials may be substituted without undue risk.

Barriers should be constructed between oil switches of large capacity, whether they are located directly upon a panel or built in separately from the switchboard. The opening of a high-capacity switch has a tendency to eject oil from the tank and thus increase the chances for spreading a fire, if once started. Standard high-tension practice has established rather definite distances for certain potentials. General dimensions of busbar compartments are shown in Fig. 4, which gives minimum allowable distances. It is sometimes practicable to insulate the busbars, and diminish the space accordingly. Where the space is not particularly restricted the busbars can be left bare. This question is a matter largely influenced by the surroundings. In a number of cases busbars for 50,000 and 60,000 volts are inclosed in fiber conduit and supported on insulators, thus affording double protection against breakdowns. When double insulation is employed the distance shown in Fig. 4 may be decreased. It must be noted that where connections or joints are exposed the space between them and the barrier should be equal to that given in the table. Where high tension is employed, a dead ground is formed in making contact with a concrete barrier, the latter being a protection against fire but not serving as insulation. This fact should always be kept in mind when designing high-voltage structures.

Space Required.—After the preliminary wiring scheme has been made the first thing to be done is to begin the design of a structure adapted to the wiring layout. A large number of designs are invariably required before a decision is justified, and in many cases the details are not settled until a large part of the apparatus has been ordered. It is not out of place to state here that far too often the design of a station is so rushed that insufficient time is given to the details, and the result is an inferior plant.

One of the most difficult tasks is to arrange the apparatus in a manner which renders it entirely accessible, and at the same time does not require undue space. High-tension appliances cannot be cramped, and this fact must be conceded and respected if a first-class installation is to be had. On the other hand it is not well to allow space in excess of that demanded for convenient operation.

The space occupied and the location of the generators are more definite in the beginning than any other feature, and will show what space may be available for other apparatus. In most of the preliminary designs it is impossible to assign accurate dimensions to apparatus, since a considerable portion of it is of special design, and cannot be exactly located without working drawings. For this reason, the larger apparatus, such as generators, transformers, and oil switches should be fairly well settled first, and ample space allowed for feeder cables, busbars, instrument wiring, current transformers, potential transformers, regulators and the like. Economy in space will be influenced in a large measure by the arrangement chosen. This in turn is restricted by the nature of the plant itself, and therefore by the operating conditions.

Consider first a general wiring scheme as shown in Fig. 5, and assume for simplicity that there are four 5,000-kilowatt units, which are to deliver power over four transmission lines,

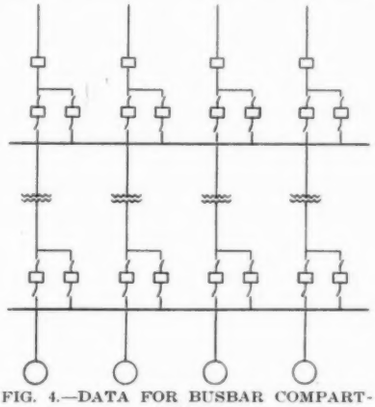


FIG. 4.—DATA FOR BUSBAR COMPARTMENTS.

each line forming a unit with a generator and set of transformers. This would be more typical of a hydroelectric plant than a steam plant, since the latter would generally include a large number of low-tension feeders for local distribution, and would not be likely to have a unit system with its high-tension side.

Assuming the generators to be 12,000 volts, three-phase, twenty-five cycles, the low-tension switches will carry normally 240 amperes per leg, at unity power-factor, or $C=5{,}000{,}000\div(\sqrt{3}\times 12{,}000)=240$. Since the power-factor will be closer to 0.85 than to unity, the normal current becomes approximately 280 amperes. The copper cross-section, with a given loss, is but thirty per cent of that required with a voltage of 6,600. The space necessary for switches remains practically the same for either potential. The reduction in copper will consequently show a decided net gain, allowing for additional cost of insulation for the higher potential.

Completing the details of wiring connections for unit No. 1, the diagram shown in Fig. 6 is obtained. If the main scheme of operation has been settled, at least far enough for a preliminary construction drawing, a general plan should first be drawn. Such a plan will take the form of Fig. 7, in which three-phase transformers are assumed. The advantage of a unit system is at once apparent, as regards the convenience in arranging apparatus. The scheme shown affords comparatively direct runs, and offers simplicity of construction throughout the plant. The

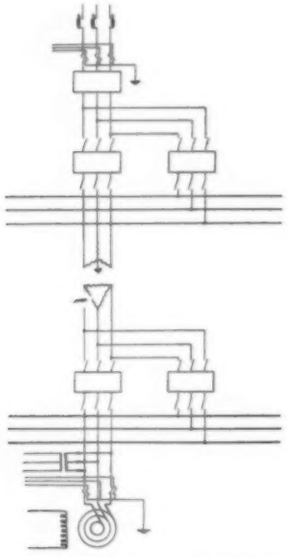


FIG. 6.—WIRING CONNECTIONS.

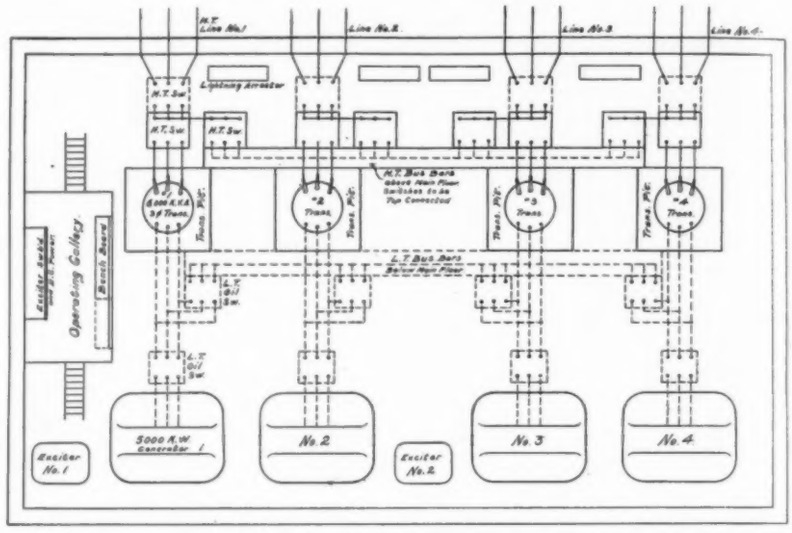


FIG. 7.—PRELIMINARY CONSTRUCTION DRAWING.

dimensions shown are of course approximate, but are sufficiently close to determine the general arrangement and the floor space required.

When the details of the plan shown are worked up, it will be found that numerous changes will suggest themselves, and this fact proves that the design of so intricate a piece of work as a power station, is developed only by a process of evolution. It always follows, therefore, that in order to have the most economical design for a given investment, the drawings must be consistent and cannot be rushed to any great extent, but must be given careful study, even of minutest details, in order that the proper choice of a system be made.

Main Leads and Bus Details.—As soon as the position of the generators has been established, and the general layout settled, the main cable runs should be worked out.

There are three principal methods of support for horizontal high-tension cables, namely: (*a*) Tile or concrete ducts; (*b*) continuous conduit supported upon insulators; (*c*) cable supported on insulators between barriers.

Single-conductor cables may in some cases be run as bare conductors upon insulators, if sufficiently protected by fireproof barriers. As a rule it is advisable to insulate conductors, up to 20,000 volts, wherever there is any likelihood of exposure liable to cause grounding or short-circuits. Quite a number of 12,000-volt installations have been made in which the conductors are in the form of bare copper tubes. These are rigidly secured to porcelain line insulators, and are separated by means of wide barriers spaced with ample distance between. Where joints are to be made, the tubing is flattened, and bolted solidly to the adjoining conductor, which in turn is pressed to a flat surface at the point of contact.

The generator leads are preferably single-conductor varnished cambric cables run in tile duct, either in the concrete floor or just beneath it. Tile duct can be secured in a solid block of concrete, and the entire structure suspended to the floor arches by means of iron straps. This method has been employed in old power stations in which it was not feasible to reconstruct the entire plant.

Three-conductor, lead-covered cable is suited to outgoing feeders, especially where they are to be carried in a basement floor, or in a place which is not proof against moisture. In places where it is not practicable to adopt a barrier system or a tile duct the conductors should be thoroughly insulated with fiber conduit, and be able to stand at least twice the working potential as security against breakdowns. The crossing of cables or other conductors should be systematically avoided, as far as possible, and, where crossing is demanded, extra insulation and fireproofing should both be used. It will be found that crossing can be taken care of by having the upper conductor or set of conductors in the flooring, or above it, while the lower set may be suspended below, and completely removed from all possibility of contact of the cables.

(To be continued.)

Central-Station Power For Coal Mines.

The Washington Coal Company, owning and operating coal mines in Durham County, England, buys the electric power for operating its mines from the County of Durham Company. A new substation containing two 400-horsepower, 6,000/625-volt transformers is now being erected at the Globe pit of the coal company.

Chicago Traction Progress.

The traction companies of Chicago report that this year's programme of new track construction aggregating over ninety-seven miles stood as follows on October 1, forty-one and one-half miles finished and nineteen miles under construction.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

ILLUMINATING ENGINEERING SOCIETY.

FINAL DAY OF THE BALTIMORE CONVENTION.

At the opening of the session on Tuesday morning, October 25, the report from the membership committee was read announcing that 534 new members had been added to the Society during the recent membership campaign. The registration at the convention was 218.

The first paper on the programme was one by Norman Macbeth, entitled "Relations Between Pressure and Light Output with Various Gas Lamps and Burners."

PRESSURE AND THE LIGHT OF GAS LAMPS.

This is a research on the effect of gas pressure upon candlepower. With the ordinary fish-tail burner the increase in pressure reduces the candlepower if no adjustment be made. Mantle lamps show an increasing candlepower with increase of pressure, and in most of them the efficiency also increases. With one form of upright mantle the efficiency is found to reach a maximum at a pressure of about four inches of water, and then decrease. The mantle lamps were given an adjustment in order to use them under their best conditions. Curves of distribution of the light at different pressure are given, and formulas for correcting the observed candlepower for pressure. Pressures used were from one to eight inches. Complete tables and curves of the results obtained are given. The consumption increases with pressure at a rate that is not quite linear.

The discussion which followed this paper consisted largely in a broadside of questions addressed to Mr. Macbeth. H. T. Owens expressed the opinion that it was more important to regulate the pressure at the burners than to know the effect of variations.

W. J. Serrill pointed out that different consumers upon a line received different gas pressures, and that the pressure varies from time to time. In Philadelphia the gas company tries to get a uniform pressure in the mains between three and three and one-half inches. The tendency among American companies today is to increase the pressure, as has been done in Europe. The only property of the gas which affects its luminosity is the specific gravity.

W. E. Barrows stated that when the Welsbach lamp was introduced in this country in 1889 it had no sale except in the regions supplied by natural gas, and the reason that it was more successful there is that the natural gas was used under high pressure. Mantles have shorter life under the high pressure.

Norman Macbeth, in closing, stated the following points in answer to questions: The pressures quoted in his paper were taken from Brown's directory and represent nominal rather than actual pressures. The lamps used were seasoned for 100 hours. The reports received covered 800 of the companies and the percentage was taken by companies and not by output. He considered that the small use of mantles in the United States was due to the fact that the gas companies had not pushed their sale. Today, however, many of them are giving proper attention to this matter, and going after the business. He does not think that the shape of the curve changes with the age of the mantle, as mantles may now be had which do not shrink, and shrinkage is the principal cause of change with time.

The next paper presented was "Some Spectral Luminosity Curves Obtained by Flicker and Equality-of-Brightness Photometers," by Herbert E. Ives.

PHOTOMETRY OF COLORED LIGHTS.

From the standpoint of accurate photometry the most important problem at present is a comparison of the equality-of-brightness and flicker methods. Of the several methods of color photometry these alone possess sufficient sensibility to warrant their use. Experiment has shown the criteria of these two methods to be different. The effect of the illumination, size of field, and differences in color vision of the observers were investigated. Five observers participated in the work and curves are given showing the relative sensibility of the two methods, the effects of changing illumination with each method, and the relative position of luminosity curves given by each method. The sensibility of the flicker method is greater under all conditions, but especially at high illuminations and in the middle of the spectrum. When the illumination is decreased the luminosity curve is shifted toward the blue end of the spectrum with the equality-of-brightness method, whereas with the flicker method the shift is in the opposite direction. The former is the well known Purkinje effect. The cause of the opposite shift with the flicker method has not been determined. The effect of changing the size of the field of view is also different with the two methods. In the equality-of-brightness method, decreasing the size of field increases the sensitiveness at the red end, but with the flicker method it decreases it. The most important fact shown by this investigation is probably that the flicker method and the equality-of-brightness method give more nearly the same values at high than at low illuminations. At the highest illumination used the mean of numerous flicker and equality-of-brightness curves would very nearly if not exactly coincide, and this is an argument for choosing such an illumination as the standard one for making heterochromatic comparisons. After deciding upon a method, standardizing laboratories should issue standards of different colors, and in the ordinary testing laboratory it should be unnecessary to compare sources of different colors.

The discussion was opened by S. W. Ashe, who referred to Professor Rood's work at Columbia University, and the necessity of co-operation between physics and psychology to solve the problems involved. He considers the flicker method the only satisfactory method. The acuity method has been tried by a number of experimenters, but has not been found so satisfactory. Much of the work which was done at Columbia after Professor Rood's death has never been published, owing to the death of Doctor Tufts, who had carried on the work. One result which was of importance was when comparisons had been made between two sets of light sources having complementary colors; a comparison of the superposed elements gave agreement with the individual measurements.

F. J. Pearson referred to his use of the flicker photometer in comparing incandescent and arc lamps and inquired whether, when such different intensities were involved, there was reason for big ranges of variation in the results which he had found. His measurements had been checked by a Weber photometer and color screens. In closing the discussion Dr. Ives called attention to the fact that if Mr. Pearson had used alternating current in his arc lamps there would be a flicker which

would be superposed upon the flicker of the photometer itself and would cause trouble.

Answering another question by G. C. Keech with regard to the use of photographic plates, he pointed out that no other detector than the eye can be used until such detector has been calibrated in terms of the sensibility of the eye. Consequently the fundamental problem was the one with respect to the eye.

The next paper was entitled "The Temperature Rise Due to the Energy Radiated in the Lower Hemisphere from Different Light Sources," by J. G. Felton and E. J. Brady. The paper was presented by Mr. Brady.

TEMPERATURE RISE DUE TO LIGHT SOURCES.

This describes the work of the authors in investigating by means of a bolometer the distribution of total radiant energy around various sources of light. These sources included both gas and electric lamps with different kinds of shades and reflectors. In certain cases the curve of distribution was found to have the same shape as the curve of distribution for light, but in some other cases there was a marked difference in the form of the two curves. No explanation of this is given by the authors, but it is expected to investigate the matter further. It is to be noted, however, that the differences are found principally with opal or frosted globes. Curves are given for different forms of lamp, showing also the ratio of temperature rise to candlepower at different angles in the lower hemisphere of the lamp, and these aid in comparing lamps of different candlepower.

H. E. Ives pointed out that it would be interesting to make such a comparison between clear and frosted bulbs, since the latter do not diffuse the long rays so much as the visible rays.

C. H. Sharp criticised some points of design of the bolometer and pointed out the effect which the hot air from the gas lamps and the ceiling would have in increasing the radiation received upon the floor. This effect is one which would not be present with electric lamps.

Norman Macbeth stated that radiant heat would retard the growth of hair and recommended this as an argument against suspending lights directly over a customer's head.

The final paper of the session, "Report of Progress on Flame Standards," by E. B. Rosa and E. C. Crittenden, was presented by Dr. Rosa.

PHOTOMETRIC FLAME STANDARDS.

This paper describes the work which has been done at the Bureau of Standards to determine the adaptability of Hefner and pentane lamps for primary standards. It is shown that the common specifications for these lamps do not give as great uniformity as is desired. Variations between different Hefner lamps have been traced to differences in the wick tube, whose thickness and conductivity for heat vary from lamp to lamp. The Krüss form of sight is favored, as it is less fatiguing to the eye, permits more consistent settings, and a higher degree of reproducibility. The variation of candlepower with humidity has been determined and the value of this coefficient found to agree with the work of Liebenthal, being 0.56 per cent per liter of water vapor per cubic meter of dry air. With weather conditions actually encountered this correction has a range of about thirteen per cent. It is shown that with a flame height of forty-five millimeters the Hefner lamp would give very closely one international candle. Even greater differences have been found in different makes of pentane lamps, and it was also found that the material on the market sold as pure pentane was not sufficiently uniform for the purpose. The pentane lamp when first lighted increases in candlepower up to a maximum, and then decreases to a steady value, the time for arriving at which varies with different lamps and ranges from fifteen to thirty minutes. The humidity correction for the pentane lamp has been found the same as for the Hefner lamp, and it is believed that this will apply to all forms of flame lamp. This is in disagreement with the value determined by Patterson at the National Physical Laboratory, and it is believed that the latter is incorrect. His value is 0.66 per cent. The differences between different ten-candlepower pentane lamps amounted to as much as 0.25 candlepower. As to reproducibility, a given pentane lamp is more accurately reproducible than a Hefner lamp when both are operated under correct conditions, but there is a greater difference among pentane lamps than among different Hefner lamps. For this reason the authors considered that the pentane lamp with suitable specifications would be preferable as a standard, but the present specifications are inadequate. It is to be preferred to the Hefner also on account of the color of the flame. It is not considered necessary to consider the effect of carbon dioxide upon the candlepower if proper ventilation is arranged for. The authors prefer continuous ventilation and the exclusion of the products of combustion from the room. While the electric incandescent lamp is to be preferred as a working or secondary standard, and for maintaining a primary standard, the flame lamps are considered valuable for checking this standard from time to time by entirely independent means. With a particular lamp, results are reproducible to a few parts in one thousand, and with proper specifications the unit would be reproducible with about the same order of accuracy.

The discussion of this paper was taken up at the afternoon session and was opened by C. O. Bond, who pointed out that a pentane standard was very useful in cases where a battery was not available for a secondary electrical standard. He also pointed out that one reason why Harcourt had not discovered some of the minor changes which might occur in this type of lamp was that at the time his investigations were made there was no better standard against which to test.

W. H. Gartley pointed out the importance to the gas interests of a flame standard and the desirability that the same correction should apply to the secondary standard used as to the flame being tested. While the candlepower has in many places been the legal test of the quality of the gas supplied, the calorific value is being introduced in some places as a test in place of the candlepower.

A. H. Elliott spoke of the use of other wicks than the specified one in the Hefner lamp, and stated that he had not been able to discover any change in the candlepower in the use of different wicks. He referred to the troubles which he had experienced in the use of the pentane lamp due to impurities, the danger of fire, etc., and pointed out that a metallic-filament lamp was not suitable for a standard in comparison with gas lamps. According to his experience the only hygrometer which was equal to the Assmann for accuracy was the swinging hygrometer. Results obtained by the use of calcium chloride, sulphuric acid, etc., in the determination of moisture are very misleading.

E. C. Crittenden, replying to a number of questions, stated that as far as observed the same effects were obtained with the flame height of forty-five millimeters as with the standard flame height of the Hefner lamp, and the same corrections for humidity, etc., were found to apply to sources of different intensities. The geometric center of the flame was used as a photometric center in their tests. The Carcel lamp had been tried and found to have a mean candlepower of 9.6, but as the variations were as large as five per cent it was not considered worthy of consideration as a flame standard.

E. B. Rosa, in closing the discussion, spoke of the possibility of improving pentane by choosing closer limits of distillation temperature so as to get a purer illuminant. In specifying any flame standard as a primary standard not only should all the details of the lamp be exactly specified, but the distance from the photometric screen at which it should be used ought also to be specified. Of course, any new specifications which may be considered in order to define the unit more closely should receive international consideration and be adopted only by international consent. The Society should take action to bring both this matter and that of heterochromatic photometry to the consideration of an international commission.

The reading of papers was interrupted at this point to receive the report of the committee on the presidential address, which stated that there was nothing in the report requiring action by the Society. The report was adopted and the committee discharged.

The regular programme of the afternoon was then taken up and consisted of three papers dealing with the value of illuminating engineering to practical men. Three papers were presented and were discussed together. The first of these was by W. J. Serrill on "The Value of Illuminating Engineering to the Commercial Man." The second, by J. F. Gilchrist, was entitled "Practical Value of Illuminating Engineering to the Central Station." The last paper was by V. R. Lansingh on "The Value of Illuminating Engineering to the Manufacturer." In the absence of the author the paper by Mr. Gilchrist was presented by Mr. Jones.

VALUE OF ILLUMINATING ENGINEERING TO THE COMMERCIAL MAN.

Mr. Serrill's paper dwelt on the value to the commercial man of a gas or electric company of a reasonably good knowledge of illuminating engineering. The subject was considered in three aspects, first being the design and development of lighting units. The commercial man is concerned with this only to the extent of advising the designer in regard to the public taste and the extent to which the public purse is opened to its gratification. Secondly, the determination of light distribution and other characteristics of available units is necessary by the laboratory men in order that the commercial men have a knowledge of what they are selling and can sell intelligently in view of the sharp competition now prevailing between different types of illuminants. Thirdly, a knowledge of the application of the available units to the spaces to be lighted, or applied illuminating engineering, is of the utmost importance to the lighting solicitor. He must be able to state on short notice for his company whether it can light a certain space satisfactorily, or whether it can improve on the present lighting, and what it will cost to do so. In other words, the lighting solicitor should be thoroughly educated in the principles of good illumination. He should attend the meetings of the Illuminating Engineering Society and absorb all he can of how to lay out a creditable lighting installation. He should co-operate with the other branches of the profession in order to get the greatest good from it in his salesmanship.

VALUE OF ILLUMINATING ENGINEERING TO THE CENTRAL STATION.

Mr. Gilchrist's paper shows clearly that the central stations have benefited from illuminating engineering chiefly in that it has made their new-business departments alive to the scientific and economic requirements of good illumination. It has made the lighting salesmen able to handle lighting problems with the best intelligence obtainable on the subject. It has brought about a marked raising of the standard of artificial illumination. Installations that were regarded as models five or six years ago are now seen to be way behind the times. Consumers must be educated to this higher standard. It should be the business of central lighting stations to sell effective illumination and not merely electricity. It has been difficult to get and to hold men of engineering training in the commercial department, but now with the interesting possibilities opened up by illuminating engineering it is quite easy to get men to devote themselves to its problems. In conclusion, Mr. Gilchrist strongly urged that the lecture course now being fostered by the Society be repeated at a number of centers so that its high educational value might be extended to a much greater number. The necessary funds could easily be secured.

GROUP AT BALTIMORE CONVENTION OF THE ILLUMINATING ENGINEERING SOCIETY.

VALUE OF ILLUMINATING ENGINEERING TO THE MANUFACTURER.

In Mr. Lansingh's paper five different classes of manufacturers were considered who benefited from illuminating engineering. The manufacturer of illuminants benefits because his lamps are used more correctly and give better satisfaction, so that more are used; new fields are opened up; the quality of his lamps is improved; his salesmen solicit business intelligently and place him at an advantage over his competitors. The manufacturer of shades and reflectors must make daily use of the principles of illuminating engineering, especially if he makes prismatic glassware; to be of value the latter can be laid out only on thoroughly scientific lines in conformity to the requirements to be met and to the peculiarities of the lamp used. The fixture manufacturer has been slow to recognize the value of illuminating engineering, but the most progressive firms in this line are taking advantage of it, much to their financial benefit. To the manufacturers of contributing apparatus, such as is used in the generating station and the circuits or mains bringing the energy to the lamp, illuminating engineering has been beneficial because it has increased the lighting load through its raising of the standard of illumination and the extension of artificial lighting into new fields; all this means a much larger demand for apparatus of all kinds for the lighting circuits.

G. H. Stickney opened the discussion by calling attention to the initiative of Mr. Ryan in pushing the subject under discussion. Another class who can be greatly benefited by illuminating engineering is composed of the architects, who are hardly yet awake to this fact.

E. L. Elliott pointed out the contractor as one of those most to be benefited and that he should be an illuminating engineer.

C. H. Williams referred to the action of the Denver Gas and Electric Company, who started a course of instruction four or five years ago. Since the department of illuminating engineering has been started all salesmen are invited to take a course of instruction on this subject.

W. H. Marshall referred to a prevailing idea that the illuminating engineer is only a theoretical scientist and the fallacy of the idea that he was not a practical man. He insisted that the technically trained man made a much better solicitor than the ordinary salesman.

Norman Macbeth referred to a deal where a $10,000-contract was lost because the sale of shades and reflectors could not be made without demonstrating the value of the material by a curve showing the distribution of light.

G. B. Regar pointed out that at the meetings of the Philadelphia Section an effort has been made to state things so plainly that the commercial man would have no difficulty in understanding them.

After adopting a vote of thanks to the city and press of Baltimore, the Johns Hopkins University, and the various committees which had aided in making the convention a success, the meeting adjourned.

THE LECTURE COURSE.

At 4:30 p. m. a meeting was held to open the lecture course, which was to be given during the following two weeks. The meeting was called to order by President Remsen, who pointed out that the registration had exceeded all expectations and that the only difficulty might be in properly caring for those who were to attend the lectures. At that time 212 persons had already registered for the course, and no more were being accepted until it was found out how many of these would actually attend. He admitted that one result of the meeting had been to make him a convert to proper illumination.

Dr. E. P. Hyde, as president of the Illuminating Engineering Society, which had taken the initiative in arranging the course of lectures, was the first called upon for an address. He spoke of the development of illuminating engineering and its purposes, and dwelt upon the significance of the present course of lectures.

The representatives of a number of societies who were interested in this movement, were then called upon for five-minute addresses, and the following responded to the call: Herbert A. Wagner, representing the Association of Edison Illuminating Companies; W. W. Freeman, president of the National Electric Light Association; Wm. G. Morris, vice-president of the American Gas Institute; J. B. Whitehead, representing the American Institute of Electrical Engineers and chairman of its local section; Samuel Theobald, past president of the American Ophthalmological Society; Wendell Reber, past president of the Academy of Ophthalmology and Oto-Laryngology; J. R. Sloan, president of the Association of Railway Electrical Engineers.

Some final announcements were then made by Dr. Hyde, and the lecture course was launched. A full statement of these lectures has been given in previous issues. They will continue until November 8, and comprise thirty-six lectures by experts, covering all branches of illuminating engineering. Announcement was made that the lectures would be published at the conclusion of the course in two volumes, which will be delivered to members of the Society and persons taking the course at cost, which will not exceed $5.00.

BANQUET.

In the evening a banquet was held at the Hotel Belvedere which constituted the closing function of the convention. Gen. Geo. H. Harries acted as toastmaster and by his humor and ready wit, kept the gathering in a continual bubble of merriment. Contributions of college yells from the graduates of the various institutions interspersed with singing added to the levity of the occasion. Responses to toasts were made by Mayor Mahool, President Remsen, Dr. Hyde, and F. C. Latrobe, president of the Consolidated Gas, Electric Light and Power Company. W. W. Freeman and E. G. Cowdrey also responded informally when called upon.

Ornamental Tungsten Street Lighting in a Small Community.

The village of Nashwauk, Minn., has recently completed the installation of twenty-two ornamental tungsten clusters on its main street. Each column supports three tungsten lamps, a central sixty-watt lamp and two forty-watt lamps on side arms. An opalescent globe surrounds each lamp. The columns were furnished by the George Cutter Company, South Bend, Ind. Current is supplied from the village water and light plant. The lighting has been so enthusiastically approved by the citizens that a petition is being circulated for the lighting of all the streets in this manner.

British Illuminating Engineering Society.

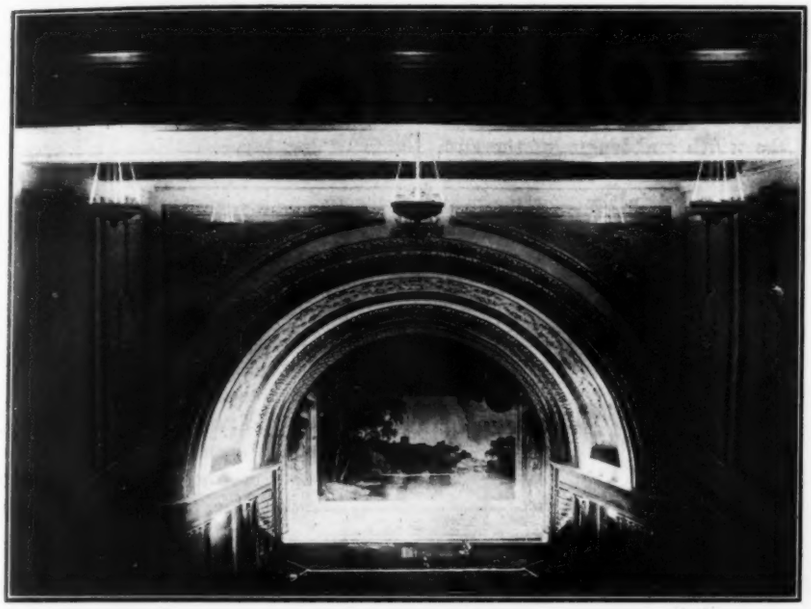
At the next meeting of the Illuminating Engineering Soicety, of Great Britain, to be held in London, on November 8, F. W. Goodenough, will present a paper on "The Present Status of Gas Lighting," and Prof. E. W. Marchant will read a paper on "Recent Progress in Electric Lighting"

The historic Territorial Church, West Port, Edinburgh, Scotland, has recently been renovated and provided with an electric lighting installation. Metal-filament lamps are used, and the illumination is very satisfactory.

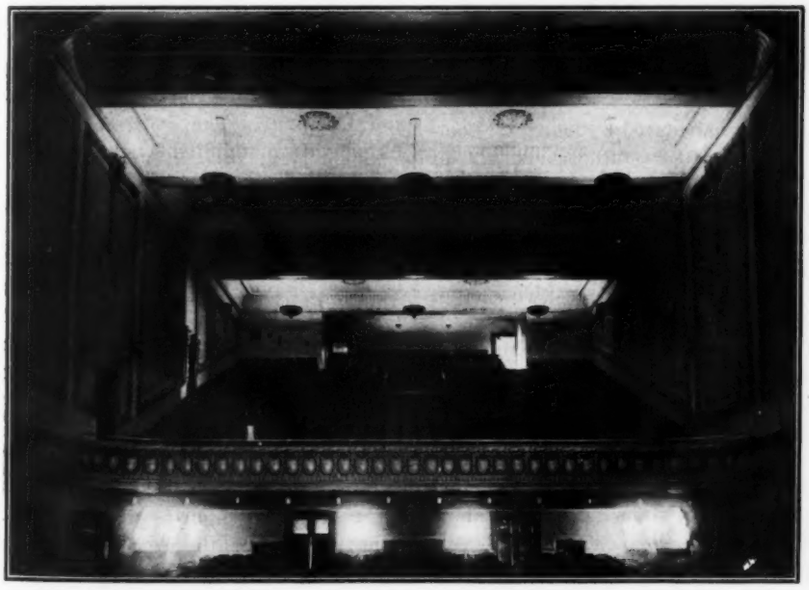
INDIRECT LIGHTING OF A THEATER AUDITORIUM.

THE PLAZA THEATER IN CHICAGO.

The recent opening of the Plaza Theater on North Avenue, near Wells Street, Chicago, marks what is believed to be an epoch in theater illumination, it being the first extensive use of indirect lighting in a theater auditorium. It also shows the important influence of good lighting on the success of a theater.



INDIRECT LIGHTING OF PLAZA THEATER AUDITORIUM AS VIEWED FROM BALCONY.



LIGHTING OF THE PLAZA THEATER AUDITORIUM AS VIEWED FROM STAGE.

This amusement house is less than a year old. The building is devoted exclusively to theatrical purposes, and was erected as nearly fireproof as possible, brick, concrete and steel being used almost entirely; in every way it conformed to the strict requirements of the city building ordinances relating to theaters. However, it was lacking in several features to make it a cozy and popular house. After several changes of management it was made evident that extensive alterations were necessary to provide the auditorium with more adequate light and heat, more perfect acoustics, and more cheerful decorations. This remodeling was carried out last summer, and on the opening night, October 17, a practically new theater was revealed that was bright, warm and attractive in every sense.

The Plaza Theater is one of the outlying theaters producing refined vaudeville at low prices that are now becoming so popular. It has a seating capacity of 1,177, over a third of the seats being in the balcony. Since the remodeling of the theater it has enjoyed a much greater patronage, the credit for a large part of which is evidently due to the improved lighting.

TYPE OF INDIRECT-LIGHTING FIXTURE USED IN AUDITORIUM.

In redesigning the lighting of the auditorium it was felt that in the indirect system there were valuable features that made it peculiarly suitable for theater lighting. In such lighting, to get fairly uniform distribution and to prevent disagreeable glare, it has usually been necessary to use a multiplicity of small incandescent units with frosted bulbs. With the indirect system the wiring is greatly simplified and a relatively small number of high-efficiency lamps can be used. In theaters of the class under consideration it is customary to keep the auditorium lighted during a considerable part of the per-

formance; in fact, in New York City all moving-picture shows are required to be produced with the auditorium lights on. The lighting for an audience under such circumstances should be restful and entirely free from glare. This is conspicuously true of the indirect system. Under it the eye can follow the performance without being distracted by any brilliant light sources. The actors can see their audience without the uncomfortable glare from direct lights.

In view of these considerations it was decided to employ the indirect system as far as possible. The main ceiling was so equipped, also the foyer. In the parquet circle directly under the balcony it was feared that there was not enough headroom for indirect units, and, as this had been the best lighted part of the house, the eight original brackets, each bearing three sixty-watt pendent lamps, were retained. Although these lamps are provided with milk-glass shades the contrast between the illumination in this part of the house and that in the parquet proper, and in the balcony, is striking. The accompanying view from the stage illustrates this clearly.

The main ceiling of this theater has six long rectangular panels running crosswise of the house. Although this architectural design was not particularly suited to indirect lighting, the latter has been quite successfully adapted to it. If this lighting system had been contemplated originally, the panels might quite readily have been made nearly square, so as to place an indirect fixture at the center of each, thus giving a uniform lighting of the ceiling and avoiding the alternate bright and dark panels to be seen in the accompanying views. However, even under the present arrangement the actual illumination of the seats throughout the parquet and balcony is quite uniform, adequate and satisfactory.

There are nine main indirect fixtures arranged in groups of three to a panel in the first, third and sixth panels from the stage. Each fixture is suspended by four chains and is of an ornamental character, harmonizing with the decorative scheme. The fixtures in the first two rows each contain six individual units and are hung with the center of the units five feet below the ceiling. The row of three fixtures above the back of the balcony holds four units each of the same type, but placed nearer to the ceiling. Each indirect unit consist of a 100-watt tungsten lamp set with tip up in an independent distributing-type reflector with corrugated and silvered surface, these reflectors being entirely screened from view by the ornamental fixture, which has an internal diameter of thirty-two inches and a depth of nearly sixteen inches over all. A good idea of one of these fixtures may be obtained from the accompanying illustration. The ceiling is forty-nine feet above the main floor and the width and length of the auditorium are 49 by 105 feet. The energy expended in the nine main fixtures is 4,800 watts or 0.935 watt per square foot. The illumination at the

INDIRECT LIGHTING OF THE FOYER.

seats was calculated as being 2.3 foot-candles. In the southeast corner of the balcony is a fireproof room for the moving-picture and spotlight equipment, which reduces the width of the seating capacity at the rear. Over this portion of the balcony two smaller indirect lighting fixtures were placed; each of these has a 100-watt tungsten lamp with its reflector. On each of the side walls of the balcony three three-light brackets, like those below the balcony and originally in place, were left, but these are entirely superfluous, as the indirect units supply an abundance of light. In next to the rear ceiling panel is a row of eleven emergency lights on a separate circuit controlled from the box office; these are required by the city ordinance. Under the front edge of the balcony is a similar row.

For lighting the proscenium arch five 100-watt tungsten lamps were mounted in "Scoop" window reflectors that were set in flush in the ledge at the base of the arch on each side, thus giving an indirect cove-lighting effect to the arch.

In the foyer of the theater three indirect fixtures were provided. Each of these holds two 100-watt tungstens set in individual distributing-type reflectors. The bowl is of spun brass eighteen inches in diameter and ten inches deep, with an ornamental band at its top. As shown in the illustration of the foyer, there is a vaulted ceiling and the fixtures are suspended forty-two inches below this. The dimensions of the foyer are 10 by 49 feet, so that there is an expenditure of 1.22 watts per square foot of floor area, which produces a calculated illumination of 3.1 foot-candles.

The entrance lobby of the theater is lighted by means of a combined direct and indirect fixture. Suspended by chains from the ceiling is a canopy holding six 100-watt lamps with their individual indirect reflectors. In the center of the canopy is an opal ceiling bowl fitted with three lamps. Suspended from the edge of the canopy are eighteen pendent frosted lamps. This fixture is quite attractive. At the edge of the canopy in front of the theater are thirty-four tungsten lamps in opal globes. On the front of the building are six flaming-arc lamps.

With the exception of the latter, all the lamps in the parts of the theater described are tungsten lamps. Current is furnished by the Commonwealth Edison Company. The indirect lighting fixtures were supplied by the National X-Ray Reflector Company to suit its calculations of the engineering requirements. The remodeling of the lighting equipment was planned and executed by the Pierce Electric Company, of Chicago. Under the management of F. W. Hartmann the remodeled Plaza Theater has now become an attractive and justly popular family theater.

National Electric Light Association Membership.

According to figures given in a recent number of the *National Electric Light Association Bulletin*, there was a gain of not less than 400 members during the summer months. The membership is at present 5,905, being distributed as follows: Class A, 897; Class B, 4050; Class C, 14; Class D, 220; Class E, 724.

TELEPHONY—TELEGRAPHY, and WIRELESS.

WIRELESS COMMUNICATION AS APPLIED TO RAILROAD LINES.[1]

BY LEE DE FOREST.

A subject of this type must necessarily deal largely in futures, yet the demonstrated possibilities of the radio-telegraph and telephone and the strict requirements of the railway service are today so well known by the experts in each separate field, that, by conferring and co-operatively working together, it is reasonable to suppose something tangible, and of real value to both may rapidly result. The possibility of telegraphing wirelessly to moving trains over considerable distances by means of the old fashioned spark telegraph was, I believe, first demonstrated in 1905 over the Chicago and Alton Railroad out of Chicago and St. Louis.

Thanks to the enlightened interest which the officials of that road took in my proposals, I was allowed the privilege of experimenting on the fast daylight express between St. Louis and Chicago. Two horizontal antenna wires were first run on insulators along the top of the train and connected to a receiving instrument installed in the parlor compartment of one coach. Earth connection was made to the trucks. The fifteen-kilowatt station at East St. Louis, about two miles from the trackside and the ten-kilowatt station at Chicago, a quarter mile from the rails were used as transmitters. No attempt was made at that time to transmit messages from the train. But, unfavorably situated, as both these stations were so far from the tracks, messages were clearly received on the flying train when thirty to thirty-five miles from these stations.

Subsequent experiments at New Haven, Conn., and Toronto, Canada, demonstrated the correctness of my view, that the track rail system, including the mass of telegraph or telephone wires along the right of way served not only as a conducting zone or wave chute along which the electric waves preferred to travel; but also acted as a net to catch waves coming transversely and obliquely towards the right of way, and then distributing in both directions along the track a surprisingly large amount of electric energy.

On account of this directive action of the telegraph wires it is easy to pick up strong wireless telegraph signals by a wave detector connected to a short horizontal wire stretched parallel and near to the telegraph wires, and at a surprisingly large distance from the wireless transmitting station.

Now, given this phenomenon, it is easy to understand how a trackside wireless station, using a horizontal antenna wire, say 100 feet long, fastened to two or three telegraph poles, can communicate with another trackside station similarly arranged, and distant twenty or even more miles from the first.

Obviously one or both of these stations can be located on board a train, and in such case the horizontal antenna wire can, as I have demonstrated, be run inside the cars, of heavily insulated wire, parallel to the bell cord. This is, of course, providing that the cars are of wood and not of steel. In the latter case wires would need to be supported on insulators a few inches above or at one side of the roof of the cars.

By this arrangement it would be a comparatively simple matter to telegraph regularly to and from express trains, over a distance of, say, forty miles (twenty miles on each side of the trackside station). However, the commercial applications of such a wireless telegraph service would be generally confined to a few limited trains, where for the benefit of traveling business men, a news or stock report service could be made a feature. The expense of carrying a telegraph operator on board more than the cost of the equipment entailed, would greatly limit such application.

With the radio telephone, however, the case becomes very different, so different in fact that it is my firm belief that ere many years the telephoning to moving trains, and especially to locomotives, will become a very common, or well nigh universal adjunct to our elaborate railroad safety applicances.

For such a purpose, long distance of communication will be quite unnecessary, in fact, undesirable. Consider a railroad system equipped with the block system, with signal stations or towers at mile intervals; a small wireless telephone transmitter capable of half-mile communication and utilizing the inductive or "wave-chute" action of the existing telegraph wires would cost little to install, little to operate, and be so simple as to add practically nothing to the training of the signal operator. A horizontal antenna wire would be extended to the first or second telegraph pole stretched three feet below the lowest telegraph wire, the earth connections would be direct to the track rails. On the locomotive or over the locomotive and the first coach will extend an insulated wire as easily coupled up when making up the train as is the air brake at present. In the cab a small box is fastened containing a tuning coil and a simple crystal wave detector; connected to this is a single head telephone receiver with headband attached, or a telephone receiver with rubber air pad is fastened to a short arm, at a point where the engineer can easily rest his ear against it. The body of the locomotive, of course, supplies the earth connection.

This system would enable the signal man to talk direct to the engineer for a period of one to four minutes, and add immensely to the probability that he will perceive the proper signal, or enable him to receive orders or information which the semaphore cannot possibly communicate. The engineer could reply only by whistle.

1 Abstract of a paper read before the Association of Railway Telegraph Superintendents at the recent convention at Los Angeles, Cal.

It would appear that by this appliance it will be generally quite unnecessary for a train to stop merely to receive dispatcher's orders. What value this saving of time of hundreds of trains would aggregate to the railroads in a year, I have no means of estimating. Surely it would total very large figures.

Arrangements have already been made with the New York Central for carrying out a series of experiments in telephoning thus to moving trains, from a trackside station at Spuyten Duyvil, on the Hudson; and I expect soon to be able to publish some very interesting results.

A short-range wireless telephone transmitter for such service as I have just described is operated from a few cells of Edison-Lalande battery, and the entire transmitting outfit will occupy less than three cubic feet of space.

Now consider the application of such wireless telephone instruments to freight train service, on roads like the Santa Fe, for example, without block signal stations at short intervals.

It frequently happens that a train awaits on a siding for long periods the passing of another which has been delayed by accident or other cause and with no means whereby the train crew can be notified to proceed. A portable telephone set installed in the caboose could be quickly brought into action to call up the nearest dispatch station.

To facilitate this work a length of flexible antenna wire can be very quickly spiked up on two or three telegraph poles as high as a man can reach, parallel to the telegraph wires or directly connected to a wire through a small condenser, the capacity of which is too small to allow any detrimental grounding of the wires. This "emergency antenna" can be strung up and taken down again in two minutes' time. Such means for getting quick communication with stalled freights will mean an immense saving in costly delays to freight and to all trains affected by the tie-up, to say nothing of loss in wages to idle train crews.

I believe that the railroads will soon see this method demonstrated, and be quick to admit the economy to them of equipping every caboose or a car on every accommodation train with such portable wireless telephone transmitting and receiving sets, whether or not the locomotive carry the receiving apparatus described above.

Ideas as to the possibilities of our land wireless telegraph for commercial purposes have been generally founded on the all-too-plainly demonstrated failures and shortcomings of the spark systems. Such service is limited to relatively short distances over land by daylight, on account of the sad inefficiency of the spark wireless transmitter. The best of the spark systems can radiate generally less than ten or twelve per cent of the energy taken from the dynamo, then the trains of electric waves which the spark transmitter sends out are strongly damped. Sharp tuning at the receiving station to cut out interference from other stations or from atmospheric causes is really quite impossible when one has to work with these strongly damped waves from a spark transmitter.

Hence, in addition to the short ranges necessitated, the spark system is not, and cannot be made reliable and "interference-proof." Such means, therefore, as supplementing the wire service of a railroad at times of emergency, as when long stretches of wire are mowed down by sleet and wind storm, is quite impracticable because so altogether unreliable.

During the last year, however, a new epoch in wireless telegraphy has been entered, marked by the "Radio-tone" transmitter (as it is called) which is sparkless and noiseless. In place of the noisy, crude and inefficient old spark gap, it employs a silent discharge from the antenna wires and emits trains of waves which are only very slightly damped.

Moreover, we can now radiate fifty to seventy-five per cent of the energy derived from the alternating-current dynamo instead of the ten to twelve per cent of the spark system. This means that ranges two or four times greater than those given by the old spark method are possible and that wireless interference from natural or artificial sources can be completely and successfully eliminated.

I have a photograph taken in San Francisco of a two-kilowatt installation of the sparkless Radio-tone system on board the United States Army transport *Buford*. The first day this apparatus was put in operation the *Buford*, lying at her wharf in San Francisco, communicated in bright daylight with a naval station at Point Aguillos, nearly 300 miles south, a new daylight record on the coast. A number of other army transports are now being equipped with this system, replacing the spark apparatus.

The art has now actually reached the stage where we can begin to handle overland business in competition with wire lines.

Therefore, the sparkless wireless telegraph possesses immediate interest to railroad telegraphers as ready means for communicating over long distances between division headquarters, especially at times of emergency when storms and washouts have cut wide gaps in the wire system.

I foresee this use of the wireless telegraph coupled with short range telephone safety signaling and emergency service as occupying a very extensive field of usefulness to railroads and the traveling public.

Telephone Offer Revived.

The old offer of the New York Telephone Company to pay the city for exclusive franchise was revived at a recent meeting of the Board of Estimate in New York.

This offer was first made to the Board in September, 1906, and embodied a promise to pay the City for the monopoly of the telephone business $116,000 a year for five years, $176,000 a year for the next five years, and $200,000 a year thereafter; to furnish service to the City at fifty per cent of the schedule rates; to file an annual statement with the Controller, and to adjust rates periodically to limit the net earnings of the Company to ten per cent on actual invested capital, less depreciation.

Telephones in Philadelphia Schools.

In each of the 330 public schools of Philadelphia there have recently been installed one or more telephones. The total number of school stations is 685. They have proven of great service in providing ready means of communication between superintendents, principals, teachers and parents of the pupils.

Telephone Train Dispatching in Georgia.

The Georgia Railroad has installed telephones for train dispatching upon 246 miles on its road. There are twenty-eight stations between Atlanta and Augusta and thirty between Camak and Macon. B.

The New York Subway Situation.

At a public engineering meeting in the Engineering Societies Building, to discuss the rapid-transit situation in New York City, Frank J. Sprague read a paper entitled "The New York Subway Situation." An abstract follows:

Taking as a theme a recent statement by Mayor Gaynor that the rapid-transit problem narrows itself down to the question whether the existing subway system, owned by the city but operated under a lease by the Interborough Rapid Transit Company, shall be extended over natural lines of development, or an independent system competitive to it shall be constructed by city funds, the author reviews the history of subway developments from the time of the Board of Rapid Transit Commissioners to the present, and details the construction of the subway with city funds after all previous attempts had failed. He gives as the city's equity in the present system a total construction cost of $62,875,000, on which but $50,420,022 of city revenue bonds were issued, the difference of nearly $10,500,000 having been supplied by the Interborough Rapid Transit Company in self defense, but states that the total bond issue on rapid-transit account, including $8,750,000 expenses of the old and new commissions, and some new city construction is nearly $65,000,000.

For interest and sinking fund the annual payment by the Interborough to the city now amounts to $2,181,204.

Since the equipment account is about $30,000,000, the total investment reaches nearly $93,000,000, or $1,132,000 per mile of single track. The system covers 25.63 miles of route, 81.94 miles of track, and carried last year 238,430,000 passengers, with a maximum in one day of 1,179,000.

Among the late activities of the old Board of Rapid Transit Commissioners and one of the first of the new Public Service Commission was the undertaking of the construction with city funds of the Bridge Loop and the Fourth Avenue Subway, and he quotes Commissioner Bassett as saying in a recent opinion objecting to the Tri-borough plans, that the actual cost of these sections and the extensions thereof would be forty per cent more than originally estimated. For the first part alone covering 5.3 miles of route, the author gives $27,500,000 as the present indicated cost, or over half the amount of city bonds outstanding against the present system with its nearly twenty-six miles of route; and he also states that the Loop has apparently entirely failed as to its originally proposed functions, for on account of the extraordinary grades, amounting to fully five per cent on short curves, operation on the Brooklyn and Manhattan bridges from the Center Street terminal will always be attained with great danger.

Pending the construction of the proposed larger systems, it is understood that these tracks will probably be leased to the Brooklyn Rapid Transit Company for the operation of both elevated and surface cars.

The various efforts of the Interborough to increase its trackage and routes is detailed from the time when, in June of 1909, and before the city had available funds, proposals were made to materially extend both the subway and the elevated divisions with private capital on condition of the granting of franchises coterminus with those already in force.

The failure of negotiations was in part responsible for the release of self-supporting bonds, with which to provide the city with means by which subway construction could be independently undertaken. This so changed the situation that the Interborough Company, realizing the impossibility of subway construction with private capital if competing lines were to be built with city funds, made new propositions in which, on demand of the Public Service Commission, the projects for elevated and subway extensions were separated. The general conditions of the subway proposals made in July of the present year, as already set forth in the public press provided for the use of city funds, division of profit after various deductions for interest and sinking fund, upkeep and operation, and a possible recovery by the city of the new section in ten years.

Attention is also called to the development of the Hudson-Manhattan System and its proposed extensions as a factor in the subway situation.

The proposed system and the interim hearings on the subject of elevated extensions are discussed at length, and the author does not hesitate to condemn unreservedly the Tri-borough projects.

Comparison is made of the routes of the Interborough and its proposed extensions and the Tri-borough, and it is pointed out that while for the main line north from Forty-second Street and Lexington Avenue the routes are identical, from this point south they are competitive for nearly four miles, within a block of each other, while the Tri-borough entirely ignores the traffic requirements of the entire west side, especially below Times Square, as indicated by the location and needs of the Pennsylvania and Long Island Station and the Hudson-Manhattan Subway. It is also shown that instead of being a continuous system the Manhattan and Brooklyn sections of the Tri-borough are entirely distinct, crossing each other at different levels at Canal Street.

One notable feature appearing in the plans of the Tri-borough are the enlarged dimensions, the individual tunnels being nearly two feet greater in height and width than the Interborough dimensions. Concerning the disadvantages of this he quotes Commissioner Bassett at length.

The proposal to admit foreign cars, which has been stated by the commissioners as the reason for the increase of dimensions, is condemned. The importance of interchangeability is also pointed out.

On the subject of ventilation by piston action of the trains, doubt is raised as to its efficiency in the present case, and it is pointed out that with the standard size of subway cars in common use, they would at the most occupy but forty-eight per cent of the clear area of the subways as proposed.

The interim hearings on elevated extensions at a time when bids are due on specifications is sharply criticized.

Irrespective of any other consideration, the author holds that for financial reasons alone there is not the slightest likelihood of the receipt of any acceptable inclusive bid for the construction and operation with private capital of the Tri-borough System, including the taking over of the parts already constructed or under way.

Assuming that the present subway system should be the nucleus of a logically developed extended system, but that on account of the difficulty of arriving at an agreement between the Public Service Commission and the Interborough interests it may be necessary to adopt heroic measures, the author proposes an alternative route.

In the main this is identical with the proposed Interborough and Tri-borough routes above Forty-second Street, but stopping short of the full extensions; going south, the route continues down Lexington Avenue and across between Fortieth and Thirty-sixth streets, through the Herald Square district, and to and down Seventh Avenue to Canal Street, from which one branch would continue to the Battery, while another branch would run through Canal Street to connect over the Manhattan Bridge with the Flatbush and Fourth Avenues subway sections to Forty-third Street. A natural extension would be to Coney Island, and also later Ashland Place and the Queensboro Bridge would be connected by lines through Lafayette Avenue and Broadway to their intersections.

The paper is summarized on the basis that no satisfactory bids will be received for the construction and operation by private capital of the Tri-borough System, in which case the author believes that the best interests of the city will be secured by the following:

Rejection by the Board of Estimate of all bids for construction alone by city moneys of portions of the Tri-borough route.

Cessation of present negotiations, or withholding approval by the Board of Estimate of any negotiations tentatively concluded by the Public Service Commission relating to general third tracking and extensions of the elevated railroad considered independently of subway extensions.

Withdrawal of all present plans and specifications for the construction of the Tri-borough route or any new portion thereof, as originally advised by one of the commissioners.

The prompt determination of a new and independent route, following in general Lexington and Seventh Avenues, with a junction between Forty-second Street and Thirty-sixth Street, as indicated, so planned and proportioned that it may be constructed and operated independently of the present subway system, or if satisfactory arrangements can be made now or later as an integral part of it.

The preparation of new plans on reduced dimensions, with invitations to bid on this proposed route on the alternative basis of construction and operation by private capital, or construction alone with city funds, the franchises necessarily being varied to suit the two plans.

The preparation of a comprehensive plan of subways, using the composite system formed by the ultimate union of the present subway system and the proposed Lexington-Seventh Avenue line as a nucleus, so designed that the equipment of all underground railways in New York City can be, if desired, interchangeably operated.

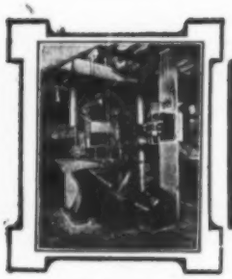
Abandonment of the proposition for the indefinite possible use of the subway by foreign cars, and limitation of its use to strictly urban and local puposes.

The undertaking of adequate tests to demonstrate the utility of separate tunnels for effecting ventilation, as compared with a system of forced ventilation initiated between subway openings.

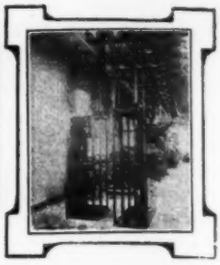
The abandonment of attempts to seek the construction of a subway system by private capital in competition with construction by the city with public funds.

The establishment as an essential of subway extension where they may be required by local interests, but are not sufficiently promising to ordinarily warrant investment of public or private capital, by local assessments, with possibly the issuing of a special bond in like amount bearing interest only when such extensions shall in the matter of earning capacity meet the conditions laid down for such portions as are constructed by public funds.

The establishment might also be profitably considered of a co-ordinating board of engineers, who in conjunction with the engineers of the city and the Public Service Commission may be instrumental in harmonizing the suggestions and plans of the city authorities, the Public Service Commission and the various traction interests, and should be of sufficiently high character to command public and financial acquiescence in their conclusions.



Industrial Power



MOTOR DRIVE IN A BOOKBINDERY.

BY F. J. CHISHOLM.

The Williams Bookbinding Company, located at 40 Rose Street, New York City, was organized in 1899 by George T. and W. J. Williams. In their small shop they had two machines driven by kicking power to assist their hand labor. In a short ten years, they built this into a plant having 100 of the latest models in bookbinding machinery. Due to the death of the brothers the next generation took hold of the business and have since pushed it to larger dimensions.

In 1907 the business had reached a point where the Williams Company found itself seriously handicapped by an inefficient belt drive from the cellar source of power which supplied its two floors. In order to get better variable speeds and likewise do away with the loss of production from oil and grit falling from overhead shafting, the company took up the electric drive as a solution of its troubles. The following description covers a type of control that was very little used until installed and elaborated by this company.

The source of power is a slow-speed Corliss engine installed in the basement of the building. A vertical shaft, driven by a belt from this engine, drives a jackshaft in the bookbindery by a one-fourth turn belt drive. The generator is belt-driven from this jackshaft, the latter being fitted with a clutch attachment so that the generator can be thrown onto the vertical shaft from the floor of the bookbindery.

The generator and switchboard are installed so as to occupy practically no valuable space. The generator is a forty-kilowatt, 250-volt machine and supplies current not only for operating the motors but also for lighting the plant. The generator, which is mounted on the ceiling, is belted to a horizontal shaft provided with a friction clutch, this shaft in turn being belted to a vertical shaft. By means of the friction clutch the generator may be started or stopped from the floor below.

Directly underneath the generator, as shown in Fig. 1, is the main switchboard consisting of four panels. The generator panel (second panel from right hand end) is provided with a main-line switch, a 300-scale voltmeter, a 200-scale ammeter, a field-rheostat controlling handle, and several smaller switches for the 230-volt lighting circuit. The panel to the extreme right is a feeder panel for the 230-volt lighting circuit and it also feeds the fourth-floor distribution board shown in Fig. 2. A Thompson astatic totaling wattmeter is mounted on this panel and it affords valuable information regarding the power requirements of the plant. The two remaining panels serve as distribution boards for the lights and motors of the fifth or generating floor.

FIG. 1.—GENERATOR AND MAIN SWITCHBOARD.

FIG. 2.—GENERAL VIEW OF FOURTH FLOOR.

A battery of six Dexter folders with mechanical feeders is shown in Fig. 3. The motors for these folders are started and stopped by means of two-button push buttons, six of which are located at different points about each machine, so that the attendant may stop or start the machine from any position. This is of great importance as it insures stopping the machine instantly in case of emergency and also eliminates the loss of time involved in going to a distant point whenever it is desired to start or stop the machine. These push buttons control an automatic starter for the motor. A field rheostat is also installed, and by setting this the foreman in charge can arrange for any given speed, so that the attendant need only operate

the controlling buttons. The automatic starter, field rheostat, main-line switch and fuses are mounted on a slate panel set up within the framework of the folder, but not visible in the illustration.

Fig. 4 shows a cutter, the attendant

A rounder and backer is a slow-moving machine used for rounding the back of a book. As ordinarily equipped, the electrical application consists of a hand-operated rheostat, a motor, and a foot switch to open the holding coil of the rheostat when the

the time that the attendant's weight comes on the flywheel, the operation being the same when the machine is reversed. The attendant keeps his foot on the brake most of the time. A field rheostat enables the foreman to set the speed for the output desired; this may

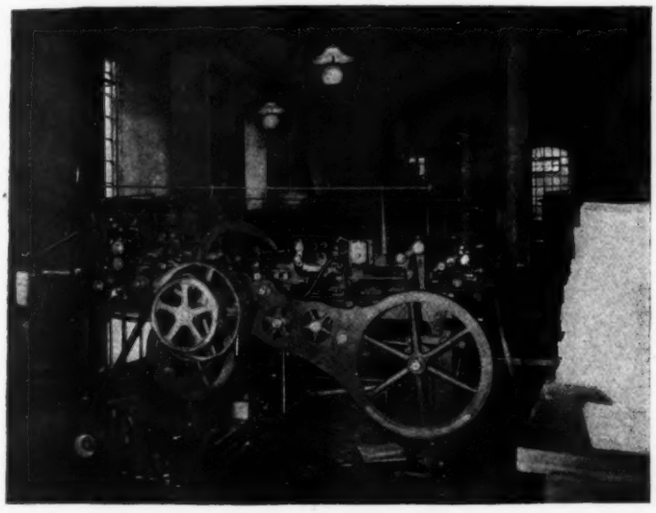


FIG. 3.—SIX FOLDERS WITH MECHANICAL FEEDERS.

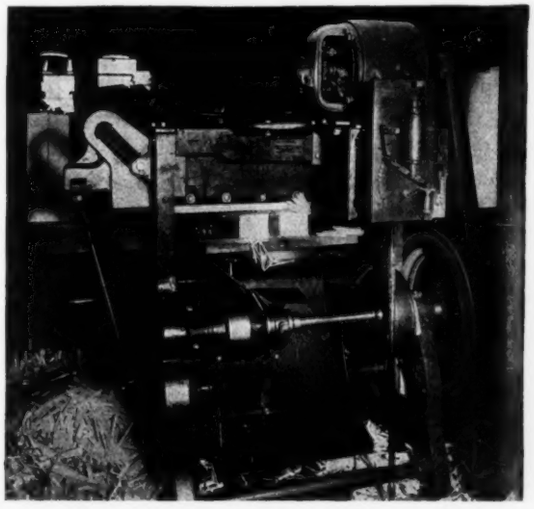


FIG. 4.—PAPER CUTTER.

of which is working busily. The motor for this machine is started and stopped about once in every ten minutes. The apparatus is self-explanatory.

The makers of the pasting machine shown in Fig. 5 did not believe that this piece of apparatus could be operated by a motor because of the fact that it had to be stopped quickly and would require an unsually strong man on the brake. A motor, an automatic starter, and a dynamic brake made this machine manageable by a girl attendant, who needs only to push the control button.

brake is worked. When it is desired to reverse the machine, the flywheel is pulled back by hand. Fig. 6 shows an arrangement by means of which considerable time is saved both in the frequent use of the hand-starting rheostat and in the cumbersome method of pulling back the flywheel by hand. The reversing switch, when moved from the vertical, will cause the automatic starters to operate, thereby energizing the motor. The foot brake is made in the form of a lever and is so connected to a contactor that when the lever is pressed down, the circuit will open at

vary from thirty to ninety books an hour according to size, shape and weight of material.

A very interesting machine is that which, from its function, is known as the gatherer. A book is usually made up of sections which will ordinarily vary in number from twenty-five to sixty. It is the purpose of this machine to gather these sections in proper order so that when delivered the pages read consecutively. The starter for this gatherer is mounted on the far wall, as shown in Fig. 7, the operating buttons being located on the machine at

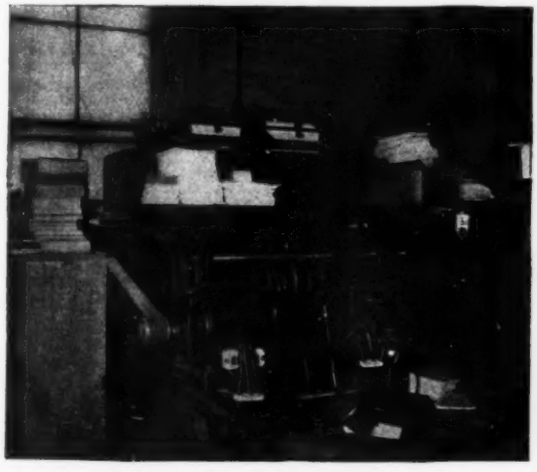


FIG 5.—PASTING MACHINE.

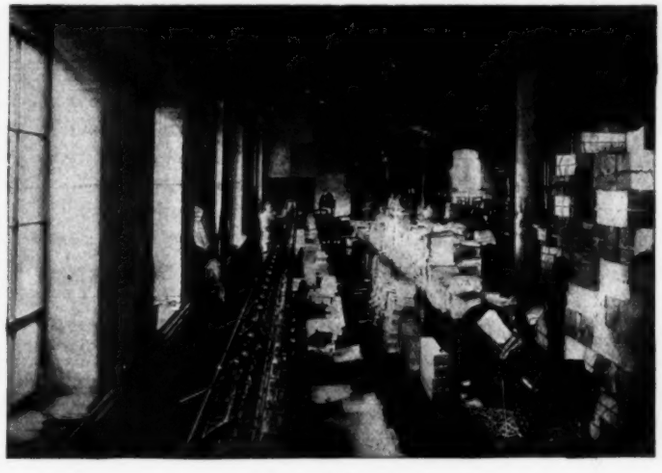


FIG. 7.—GATHERER.

the receiving end. The motor is mounted on pipe supports, out of the way, as shown.

About thirty-five motors varying in size from one-quarter horsepower to five horsepower are now installed in this plant. Small motors of one horsepower or less, operating machines which require practically no starting torque, are compounded and thrown across the line. These motors are started by three-way snap switches which give full field before the armature is switched onto the line, this arrangement obviating considerable trouble from the blowing of fuses.

Nearly all motors larger than one horsepower are provided with automatic starting devices, the result of

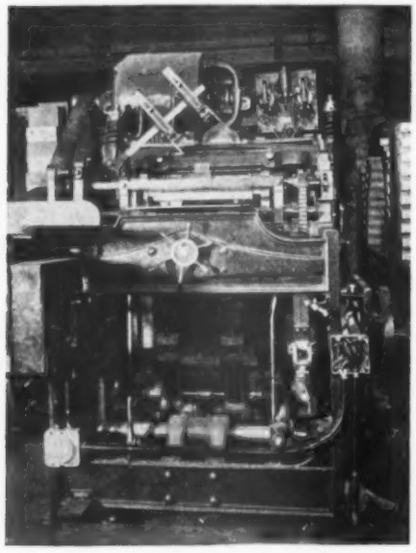


FIG. 6.—ROUNDER AND BACKER.

which is an increase of fifteen per cent in the output for a given number of men and machines. This increase in production has not been due alone to the speeding up of various machines, but to the time saved through not having the employees concerned with starting the motors.

At first, when hand-operated rheostats were used, the girl attendants would pull away from a rheostat handle when a spark occurred, several attempts usually being made before the lever was finally set on the holding coil. The male attendants, on the other hand, would hold the handle on a point until smoke came from the rheostat, when they would let the handle go and wait for the rheostat to cool. It was to eliminate these losses that the company installed automatic starting devices and the results have more than justified the expenditure.

Before the addition to the switchboard equipment of the totaling wattmeter mentioned previously, it had been the custom of the company and the owners of the building to arrive at an agreement as to the probable power requirements and to draw up a contract accordingly. The wattmeter showed an average load smaller by twenty-five per cent than that agreed upon, and a corresponding reduction was made in the price for power.

It will be noted that some of the motors have to start under weakened field. To overcome this disadvantage, twenty-five per cent extra capacity and compounding were added to the motors. With this addition, no trouble is experienced in starting up any position of weakened fields.

The electrical equipment of this plant is of General Electric manufacture throughout.

Copper and Railroad Electrification.

In a short review of the prospects of the copper market, the *Engineering and Mining Journal* says that an extremely encouraging factor is the report that several important railway systems are going to do considerable electrification in the near future. It is said, states our contemporary, that the Great Northern has decided to electrify fifty-seven miles of track on both sides of the Cascade tunnel; that the New York Central is to electrify its line between Syracuse and Geneva, N. Y., a distance of fifty-four miles; that the Boston & Maine is to electrify its line through the Hoosac tunnel; that the New Haven will electrify its main line between Boston and Providence; and that the Lackawanna is to electrify a part of its line in order to utilize power developed cheaply from the combustion of culm in its coal territory.

Electric Power for Freight Station.

The freight station of the Great Western Railway Company, near Nine Elms, London, S. W., England, will shortly be supplied with electric power from the Battersea Borough Council's electricity works. About 250,000 kilowatt-hours a year will be required, and the installation will include about 300 horsepower for motive purposes, and a number of fifty-ton cranes will also be electrically operated.

ELECTRIC REFRIGERATION IN THE MEAT INDUSTRY.

BY R. L. LLOYD.

That the motor-driven refrigerating plant operated from the central station is a decided advantage and economy over the use of ice or a cold-storage pipe-line service, has been many times satisfactorily demonstrated. As compared with the use of ice, but little argument need be used to uphold this point of view. Lower temperatures, more uniform temperatures, and better hygienic conditons are universally admitted.

It is purely a matter of dollars and cents as to whether it pays to install a refrigerating machine. Any consumer of ice who purchases over three hundred dollars worth in a year at a price not lower than $3.25 per ton will find a machine a paying proposition. Take, for instance, the retail butcher shops, which are probably the most difficult in which to make an advantageous comparison, inasmuch as they require a maximum quantity of ice at one period of the year and none at all during a few weeks of the winter. At $3.25 per ton, three hundred dollars will purchase about ninety-two tons of ice. About one-half of this will be used during three months of the summer; say four tons per week as a maximum. A one-ton plant operating about from twelve to fifteen hours a day will produce equivalent temperatures and give a drier atmosphere.

The power to operate this machine would cost, at the usual rates, about one-half as much as the ice. In addition, the meat will be found to keep in a superior condition, and this is a direct profit to the butcher, because the trimming loss will be largely eliminated.

In the operation of a plant of this character very much depends on the ability and integrity of the engineer responsible for the installation, as the highest economy can only be obtained by a very careful attention to details. The machine and piping should be properly proportioned to the work. The air circulation must be carefully considered, and the driving power so arranged as to give a maximum efficiency and least opportunity for creating trouble. The electric motor is the ideal power for this purpose.

Very important also is the quality of

the insulation on the box to be refrigerated. If this is faulty it is like trying to hold water in a sieve. In fact, too much attention cannot be given to this feature of a refrigerating plant. It is not a difficult matter to remove the heat from an inclosed space, but to keep heat out of that space is not so easy. It is an economy to be extravagant in purchasing insulation. The expenditure is made once for all time. Poor insulation occasions a continual increased expense in machine operation, and this soon amounts to much more than the additional cost for first-class insulation. Besides, there is a deal of satisfaction in knowing that when the box is once cold it will remain so over a period of forty-eight hours or more. An undue rise of temperature over night or over a holiday, during the nonoperative hours of the machine, is a detriment to the stored product.

Probably a few experiences taken from actual cases may serve to emphasize the advantages mentioned.

A butcher has a retail store in which is a box, 9 by 6 by 11 feet in linear dimensions, which holds at times as much as six sides of beef, four or five calves and a dozen lambs, a total of a ton and a half of meat. The counter case and corned-beef tank are also refrigerated, all by direct expansion. The machine used is of one-ton size set up in the basement directly under the main box. A brine tank is located in the ice bunker. This is cooled at the same time with the box and acts as a storage reservoir to hold the temperature low during the night. With a temperature of thirty-four degrees at stopping time, a rise of only four degrees will be experienced by morning. A single-pipe condenser and city water are used with this machine. The average operating hours vary from four to five per day. In the summer about nine hours are necessary, while in January and February the machine is not used at all unless an unusual hot spell occurs.

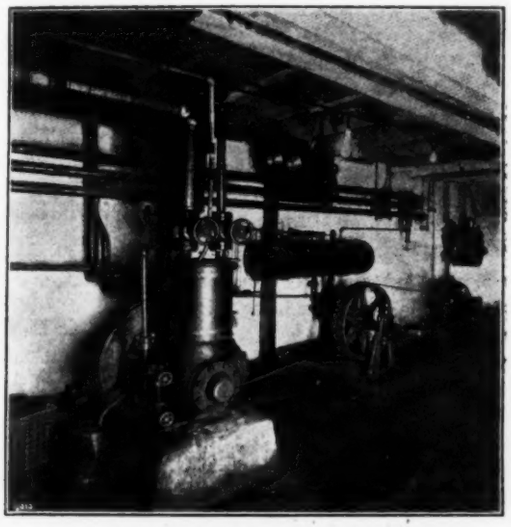
Ice formerly cost about $425 per year. Electric power for the three-horsepower motor used cost just half as much as the ice. Adding interest and depreciation charges at fifteen per cent on an investment of $1,000 makes the total operating cost of about $365, representing a saving of fourteen per cent of the former expense.

Another case is that of a butcher doing his own killing and retailing. He installed an eight-ton machine, rebuilt his two boxes and improved the conditions very materially at an expense of about $3,500. This system is also direct expansion with brine-tank auxiliaries. One of the boxes is in the store and holds the immediate supply for the counter business, together with such fruit and vegetables as the trade requires. The temperature is kept at about forty degrees. The other box or cooler is much larger, about 10 by 11 feet and 20 feet high, so that the beeves can hang well up to clear the floor. There are two brine tanks here, ranged one above the other on one side so as to give the clear height where necessary. They hold 205 gallons of brine cooled down below freezing so as to maintain the temperature in the box at about thirty to thirty-two degrees. This keeps the meat in prime condition. Killing is done two or three times a week, depending on the season and the cattle supply. Seven or eight beeves and twenty sheep and lambs are the average weekly killing. If an opportunity presents to make a profitable purchase of cattle it is a very easy matter to get the whole lot quickly hung up in cold storage. Under former conditions this was not feasible and the cattle had to be kept on the hoof and fed. This method inevitably resulted in a shrinkage of weight and added expense.

Ice formerly cost about $400. Expenses of feeding and keeping the cattle until ready to kill over $700. The cost of operating the refrigerating machine is less than $600. Also the improved condition of the meats and the very superior appointments resulting are quite gratifying.

The next reference is to a plant consisting of two twenty-five-ton machines, individually driven by fifty-horsepower motors, a pump for circulating brine and a pump for the condenser water. The rooms cooled are as follows: One main refrigerator box or cooler 60 feet by 17 feet, maintained at thirty-five degrees. Three freezers each 20 feet by 17 feet. Wall and counter display cases in the store. One pickling room 37 by 19 feet. This latter contains the brine tank holding 5,000 gallons of brine, and by its presence the temperature of the room is usually below freezing

BUTCHER SHOP USING ELECTRIC REFRIGERATION.



REFRIGERATING MACHINE IN BASEMENT.

point, though thirty-five degrees would have been amply cold enough. The freezer was divided into three rooms in order to accomplish better results and allow considerable elasticity in the accommodations. In certain seasons of the year it is necessary to take care of more of those delicacies which require the very low temperatures; and, as arranged, one, two or three sections can be utilized independently. The temperatures can be brought as low as zero in any of these rooms if necessary. Fifteen degree, is found to be ordinarily sufficient.

This installation is a beautiful example of the benefits from first-class insulation, for whereas the plant was designed to operate during a large part of the day, practice demonstrates that from two to four hours per day is ample to produce the desired results.

The charges for service from the freezing company's pipe-line system for this establishment would have been $3,100 per annum. The cost of electric power has been $2,300.

A wholesale meat dealer who handles western beef from the refrigerator cars installed a twelve-ton refrigerating machine to cool a box 90 by 26 by 11 feet. This compressor operates all day long during the warm weather, but through the winter only a few hours every other day. The box is maintained in excellent condition and the saving is even better than expected. The present cost of power from the public-service electric company is slightly above $1,000 per year. Pipe-line service at ten cents per cubic foot of refrigerator was $2,574. This comparison should certainly satisfy anyone who compares other methods with refrigerating machines and central-station service.

In large plants one and one-half horsepower per ton of refrigeration is theoretically required to drive the machine. But in practice it is found desirable to provide the following for the various sizes below twenty-five tons capacity. Above thirty tons allow one and two-thirds horsepower per ton:

1	ton	3 horsepower
2	ton	5 horsepower
4	ton	7.5 horsepower
5	ton	10 horsepower
8	ton	15 horsepower
12	ton	22 horsepower
15	ton	27 horsepower
20	ton	35 horsepower
25	ton	45 horsepower

On the small machines there are usually no by-passes and in starting a considerable force is necessary to start under pressure.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

LONDON UNDERGROUND EARNINGS.

The associated companies of the Underground Electric Railways Company, of London, report for the month of September compared as follows:

Metropolitan District Railway:	1910	1909
Gross receipts	£54,116	£50,554
Working expenses	27,972	29,316
Net receipts	26,144	21,238
London Electric Railway Company:		
Gross receipts	£54,324	£53,948
Working expenses	30,470	30,820
Net receipts	23,854	23,128
London United Tramways, Ltd.:		
Gross receipts	£29,528	£27,792
Working expenses	21,297	20,232
Net receipts	8,231	7,560

KEYSTONE TELEPHONE.

The report of the Keystone Telephone Company of Philadelphia for the month of September and three months ended Sept. 30 compares as follows:

	1910.	1909.
September gross	$94,340	$91,908
Expenses and taxes	46,574	45,070
September net	47,746	46,838
Interest	24,762	24,682
September surplus	22,984	22,156
Three months gross	282,809	272,851
Expenses and taxes	141,222	135,523
Three months net	141,587	137,328
Charges	73,640	76,828
Three months surplus	67,947	60,500

KINGS COUNTY ELECTRIC.

The report of the Kings County Electric Light and Power Company for the month of September and nine months ended September 30, compares as follows:

	1910.	1909.
September gross	$352,889	$286,822
Expenses	181,942	155,546
September net	170,947	131,276
Charges and depreciation	109,015	91,827
September surplus	61,932	39,449
Nine months gross	3,146,503	2,721,621
Expenses	1,519,816	1,333,669
Nine months net	1,626,687	1,386,952
Charges and depreciation	933,514	789,910
Nine months surplus	693,173	597,042

AURORA, ELGIN AND CHICAGO.

The Aurora, Elgin and Chicago Railway Company reports for the year ended June 30, 1910, compared as follows:

	1910	1909
Gross	$1,536,898	$1,467,214
Expenses	902,777	796,270
Net	634,120	670,944
Other income	71,539	.....
Total income	705,660	.....
Charges	373,823	341,327
Surplus	331,836	329,617
Dividends, common and preferred	279,000	255,750
Net surplus	52,836	73,867
Previous surplus	271,678	211,395
Profit and loss adjustment, debit	7,844	13,584
Surplus	316,670	271,678

Aurora, Elgin and Chicago stockholders at the annual meeting re-elected directors and approved the purchase of the Chicago, Wheaton and Western Railway, a thirteen-mile line completed a year ago, from Wheaton through West Chicago to Geneva. Its $429,000 first mortgage 5s were assumed by the Aurora, Elgin and Chicago, which includes same in balance sheet as of June 30.

NEW YORK STATE RAILWAYS.

The report of the New York State Railways, for the quarter ended June 30, 1910, compares as follows:

	1910	1909
Total street railroad operating revenue	$ 841,558	$ 766,027
Total street railroad operating expenses	513,439	487,678
Net street railroad operating expenses	328,118	278,349
Taxes accrued	59,897	46,420
Operating income	268,221	231,928
Non-operating income	211,796	80,273
Gross income	480,018	312,201
Total deductions from gross income	128,790	107,924
Net corporation income	351,228	204,277

AMERICAN LIGHT AND TRACTION.

The report of the American Light and Traction Company for the month of September shows an increase in gross earnings of $46,469 and in net of $44,692.

September—	1910	1909
Gross	$ 335,100	$ 288,631
Expenses	9,562	7,785
Net	325,538	280,846
For nine months—		
Gross	2,653,157	2,306,122
Expenses	89,424	79,190
Net	2,563,733	2,226,932

KANSAS CITY RAILWAY AND LIGHT.

The report of the Kansas City Railway and Light Company for the month of September and four months ended September 30 compares as follows:

	1910	1909
September gross	$ 628,685	$ 584,287
Expenses	365,790	323,078
September net	262,895	261,209
Charges and taxes	189,119	172,512
September surplus	73,776	88,697
Four months' gross	2,491,369	2,302,242
Expenses	1,488,174	1,306,500
Four months' net	1,003,195	995,742
Charges and taxes	749,726	690,337
Four months' surplus	253,469	305,405

INTERNATIONAL RAILWAY.

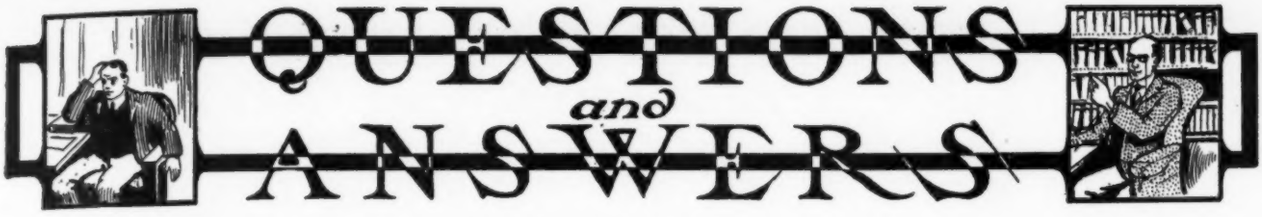
The report of the International Railway Company for the quarter ended June 30, 1910, compares as follows:

	1910	1909
Total street railroad operating revenue	$1,204,376	$1,129,535
Total street railroad operating revenue	739,008	632,468
Net street railroad operating revenue	465,368	497,068
Taxes accrued	67,860	60,344
Operating income	397,509	436,724
Non-operating income	7,089	8,758
Gross income	404,598	445,482
Total deductions from gross income	202,310	222,727
Net corporation income	202,288	222,755

UNITED TRACTION COMPANY.

The report of the United Traction Company, of Albany, for the quarter ended June 30, 1910, compares as follows:

	1910.	1909.
Total street railroad operating revenue	$537,562	$544,013
Total street railroad operating expenses	314,287	282,852
Net street railroad operating revenue	223,275	261,161
Taxes accrued	33,000	33,000
Operating income	190,275	228,161
Non-operating income	51,455	44,237
Gross income	241,730	272,397
Total deductions from gross income	96,625	107,177
Net corp. income	145,105	165,220



SERIES TRANSFORMERS.—Why must all secondaries of a series transformer be connected in series? What would be the voltage across the secondaries of a series transformer having a 30 to 1 ratio and 2,300-volt primary?—T. F., Freeport, Ill.

A series transformer has but one secondary coil, to which is connected the ammeter, or other instrument, for which the transformer reduces the current. The primary of such a transformer is never connected directly across a high-voltage circuit, but always in series with it, from which fact it derives its name. If the ratio between its primary and secondary currents is 30 to 1, then the ratio between the primary and secondary voltages is approximately 1 to 30. The inquirer seems to be referring to an ordinary shunt or potential transformer. A description of the series, or current, transformer and of its use was given in these columns on page 799 of the issue of October 15, 1910.

TUNGSTEN ADAPTER.—What is meant by a tungsten adapter?—H. M., Little Rock, Ark.

The electric fixtures, both chandeliers and brackets, that were formerly made, had the lamps pointing at an angle of forty-five degrees, or thereabouts, with the vertical. This position was not suitable for the first tungsten lamps made which had to be hung vertically to prevent excessive strain on the fragile filament. Therefore a device was developed that is like an extension socket; it can be screwed into the socket in place and has its socket swiveled so as to allow the tungsten lamp to hang vertically downward; thus it is called a tungsten adapter.

INCREASING MILEAGE OF ELECTRIC VEHICLES.—A friend of mine has an electric runabout that he claims he can run sixty miles on one charge, although the salesman he bought it of could run it only fifty miles and would not guarantee it for more than fifty. He says he can run it with less power than even an expert chauffeur, but does not disclose his secret way of doing so. As I have known him to run his car nearly sixty-one miles I would like to know wherein his skill lies.—H. O. S., Cleveland, Ohio.

Assuming the battery, tires and other features of an electric vehicle to be in perfect condition, the mileage that can be attained by it depends chiefly on the condition of the roads and on the manner in which the vehicle is operated; it depends to a less degree on the temperature of the battery. Accepting the figures given, the increased mileage is due to the selection of more perfect roads, that is, freer from hills, ruts, mud and dust; more intelligent control of the machine; or higher temperature of the battery which increases its capacity. The second cause seems probably to be the most important in this case. It is quite possible to employ the principle of "coasting" to an electric vehicle with considerable saving of power. This is done by shutting off the power when approaching a point where low speed or a possible stop may be necessary and letting the momentum of the vehicle coast it along, instead of keeping the power on right up to the point where the brakes have to be applied. Coasting should also be taken advantage of down all grades. In the case of elevated railroads it has been found that a saving of twenty-five per cent in power consumption may result from proper coasting. In automobiles the saving can probably not be made as great.

REVOLVING-FIELD DIRECT-CURRENT GENERATORS.—Has a direct-current dynamo ever been built with a revolving field and stationary armature as is so commonly used in alternators? Would such a construction not have many advantages? Why is it not used?—R. W. S., Minneapolis, Minn.

This construction is feasible and has been used for some direct-current machines. It has all the advantages of the similar construction for alternating-current generators, namely, stationary high-voltage winding with its greater mechanical strength and more perfect insulation; moreover the commutator is relieved of its great centrifugal stresses and, as it and the armature have a larger diameter, more coils and commutator segments may be provided and therefore a higher safe potential attained. Despite these great advantages, however, this construction necessitates that the brushes revolve about the stationary commutator and it is so troublesome to keep the brushes in proper adjustment that it makes the proposition an impracticable one.

COMPOUNDING OF ALTERNATORS.—1. How does the compounding in an alternator cause a rise of voltage as the load is increased? 2. Will a single-phase motor run if connected to two leads of a three-phase circuit?—H. D., Chicago.

1. The compounding of an alternator acts in the same way as that of a direct-current generator, that is, series-field coils are provided through which all, or a proportionate part, of the load current is sent after being properly rectified. Therefore, to the magnetization of the main field is added the magnetization of the series field and as this is proportional to the load current it overcomes the voltage drop due to armature resistance and the demagnetization caused by armature reaction, both of which vary with the load current. 2. A single-phase motor may be connected to any of the branches of a three-phase circuit. In fact, the three branches of such a circuit may be used just as if they were three independent single-phase circuits, but the load should be evenly balanced on them.

ROTARY CONDENSER.—What is a rotary condenser and where is it used?—A. M. V., Eau Claire, Wis.

A synchronous motor that is run idle with overexcited field is called a rotary condenser because it is a rotating machine that acts on the line just as a condenser does in neutralizing the lagging current of an inductive load. Thus it is used chiefly to raise the power factor of transmission circuits so as to give them and the generators supplying them a capacity for carrying a larger load than they have when carrying a large so-called wattless current.

New Electrical and Mechanical Apparatus and Appliances.

A New Type of Cable End Bell.

The Electrical Engineers Equipment Company, of Chicago, manufacturer of power-station specialties, has recently brought out a new and improved type of cable end bell, the novel features of which are demanding more than the usual attention. This new device consists of a cable end bell so arranged that the cable sheath is grounded at the extreme end on the cable and on the inside of the bell. The operation of installing this bell is a very simple one, as shown by the seven illustrations which appear herewith. The inside-clamp-ring feature permits of cable bells being installed, the cable being put in and the bell filled with insulating compound in a very short time. From one-half-hour to forty-five

FIG. 1.

FIG. 2.

minutes is sufficient time for the complete operation, including the melting of the insulating compound.

As shown in the illustrations, the new type of bell is so arranged that it may be screwed on top of a pipe of any description. The Electrical Engineers Equipment Company however, also manufactures a complete line of cable end bells with a clamp below or outside of the cable bell, for use on cable which is not protected by iron pipe. The advantage of providing a cable bell which eliminates the expense of wiping joints is alone of sufficient interest to the electrical trade to warrant close attention. The simplicity of the device for protecting a lead-covered cable of any voltage may be seen from the illustrations.

Fig. 1 shows the first step in installation, with the cable pulled through the protective pipe, and the polygonal iron coupling screwed down. In Fig. 2 the inside brass clamp ring has been slipped

FIG. 3.

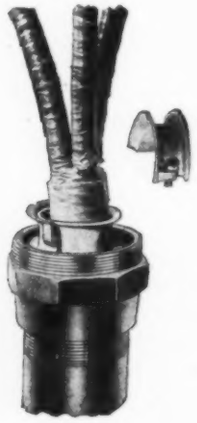


FIG. 4.

over the cable and screwed down into the polygonal bushing. The lead cable sheath, in Fig. 3 has been peeled off the cable and the end belled out to make a good fit with the clamp ring when the two are pulled together. Fig. 4 shows the cable sheath belled out and in proper position on the brass clamp ring, the clamp being screwed down for the purpose of making a good contact. The clamp ring is, in Fig. 5, shown tightened in place, and the cable is

FIG. 7.

ready for the cable bell to be screwed on the polygonal coupling. Figs. 6 and 7 show two forms of cable bells, the former being for inside service and the latter for outside installation. The first five steps as illustrated are the same for either of these forms of cable bell.

It is also interesting to note that the illustrations herein all show actual conditions of installation. The cable shown is for 13,200-volt working pressure, and the system was tested complete with more than eighty cable bells in place, at 32,500 volts, for five minutes. Absolutely no trouble developed in any of the bells. All bells are guaranteed for five-years service. Each bell is given a rigid test and two-and-one-half times the working voltage that the bell is designed for. The outside cable bells are all tested under a wet test of one inch of rain in five minutes, and are given a test of two-and-one-half times the working voltage of the bell. The new quarters of this company amply

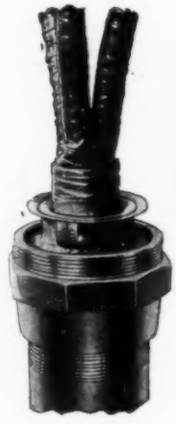


FIG. 5.

FIG. 6.

permit of its taking care of its already large and increasing business.

A New Machine for the Drafting Room.

A machine for making opaque pen or pencil drawings transparent and printable has been devised and placed on the market by Topping Brothers, of New York and is described by them in a recent catalog.

The "Mechanigraph" by which name the machine is known consists of a series of electrically warmed rolls, a bath (also electrically heated) and a pair of dryer rolls. The whole operation of making a transparent print, it is said, takes but a few seconds. Another use to which the machine may be put is the renovation of old tracings.

Lighting a Large Machine Shop with Flaming Arc Lamps.

The development of the flaming arc lamp and its general commercial application to lighting large areas has brought about an important advance in the efficient lighting of machine shops, railroad yards, foundries, warehouses, wharves and convention halls. This form of lamp owes its popularity for this class of service to its great brilliancy, its penetrating power, its low operating expense and its pleasing effect upon the eyes.

It used to be the common practice to hang up almost any kind of a lamp in a haphazard way to light a mill, but those days of inefficient lighting are past, and today the mill superintendent recognizes the fact that a well lighted shop means more and better work and contented workmen.

FLAMING ARCS IN CRUCIBLE STEEL COMPANY'S PLANT.

In foundries, steel mills and machine shops where the ceilings are high, lamps of great penetrating power must be used, because at the present time traveling cranes are used in almost every shop of any size, and in many cases it becomes necessary to hang the lamps above these cranes.

The large machine shops and foundries are generally built with two or three bays, a popular arrangement being one central bay, in which the heavy work is handled, and one or more side bays usually built with galleries in which the lighter and detail work is carried on. Often these side bays also have traveling cranes, and in that case the lamps are hung around the sides of the bay. The upper gallery and main bay, however, are generally illuminated by hanging flaming arc lamps above the cranes. Before the introduction of the flaming arc lamp no solution could be found for successfully lighting these high-ceilinged interiors where dust, smoke and vapor were always present, but in the flaming arc we find a lamp suitable for such service.

For some time the Crucible Steel Company of America, at Harrison, N. J., had difficulty in finding a satisfactory means of illuminating its gun and projectile shop. In this shop, which works day and night, turning out guns and projectiles for the United States Government, good light is imperative. The guns and projectiles made for the government are built under very rigid specifications, and each shell and gun undergoes very close inspection during the process of construction. It is apparent that without good light much of the work would fail to pass the inspection and thus be rejected.

This shop was formerly lighted by carbon arcs, but these proved unsatisfactory and incandescent lamps were added. These individual incandescent lamps were hung near the various lathes, planers and other machines, and it was thought that this would solve the lighting problem. This combination failed, however, for the men on the night shift were continually having trouble with their eyes. As a last resort flaming arcs were tried, and after a thorough test seven Western Electric Hawthorn flaming arcs were installed in the main gun shop and three in the adjoining shop. These lamps were run two in series on a 110-volt circuit, and although the voltage is very unsteady, due to the fact that two or three forty or fifty-horsepower induction motors are often started or reversed simultaneously, the lamps are operating well.

It is interesting to note the increased production resulting from the installation of these lamps. After the flaming arc lamps had been installed for some time it was noted that the increase in the amount of work turned out by the night shift was a little over ten per cent. In order to determine whether or not this was due wholly to the introduction of the flaming arcs, the lamps were taken out for a time and the night work carried on with the old lighting system. It was then found that the amount of work dropped off over ten per cent.

This increase in production is due not only to the amount of light, but to the quality. The golden yellow rays of the flaming arc lamp are stimulating in character and very easy on the eyes, and since these lamps have been installed night men have found it possible to turn out a greater amount of work with less effort than was possible with the old carbon lamps.

The problem of lighting foundries has heretofore been a difficult one because of structural conditions, overhead cranes and the presence of smoke and dust. One or two flaming arcs hung above the cranes will satisfactorily light a foundry 50 by 100 feet.

As to the economy of such an installation, the flaming arc stands out prominently as the cheapest illuminant, when we consider that a flaming arc lamp gives 3,000 candlepower at 550 watts, the operating cost is low, and so few units are required that the installation and maintenance cost is very small.

After burning for a period of over 7,000 hours, a tungsten lamp used by the Merchants' Safety Deposit Company, Chicago, Ill., is still in good condition.

More Dispatching Telephones on the Louisville & Nashville.

The Louisville & Nashville Railway Company has just completed the installation of telephone train-dispatching and message circuits, supplanting the telegraph, on its Knoxville division. These circuits consist of the following equipment:

One dispatching circuit from Knoxville, Tenn., to Corbin, Ky., a distance of 105 miles, equipped with nineteen stations. One dispatching circuit from LaFollette, Tenn., to Etowah, Tenn., a distance of 114 miles, equipped with sixteen stations. One message circuit extending from Corbin, Ky., to Etowah, Tenn., a distance of 163 miles, equipped with thirty-six stations. These circuits also connect with the Pine Mountain, Olive Spring and Marysville branches.

The lines are equipped with No. 9 B. & S. gauge copper metallic circuit. The equipment furnished is a special high-efficiency telephone train-dispatching circuit developed by the Western Electric Company. Selectors are employed for calling any station desired without interrupting the service of other stations.

The cost of equipping this division amounts to about $36,000. Complete supervision of the work, both of the dispatchers and the men along the line, has been insured by placing telephone equipment at the chief dispatcher's desk and in the superintendent's office, so arranged that by simply taking down a receiver and listening in on the line, the dispatcher and the superintendent may at all times be in direct touch and communication with any office on the entire division.

The power furnished for operating the selectors and ringing the bells is obtained from motor-generator sets. These sets are operated directly from the primary source of power available, and on alternate days, so that the sets are always in an operative condition. They are arranged so that it is possible to connect all of the offices to either the train wire or message circuit.

Test panels are furnished at all stations, making it possible to introduce a portion of the message circuit into the dispatcher's line, in case of trouble on the train wire. The dispatching panels employed in the more complicated stations are of special design, manufactured by the Western Electric Company according to instructions furnished by R. R. Hobbs, who has charge of the telegraph service of the entire Louisville & Nashville Railway system.

Work trains and repair trains on this division will be equipped with portable telephone sets, which used in conjuction with special line poles make it possible for the employees to get in immediate touch with either the dispatcher or the message operator.

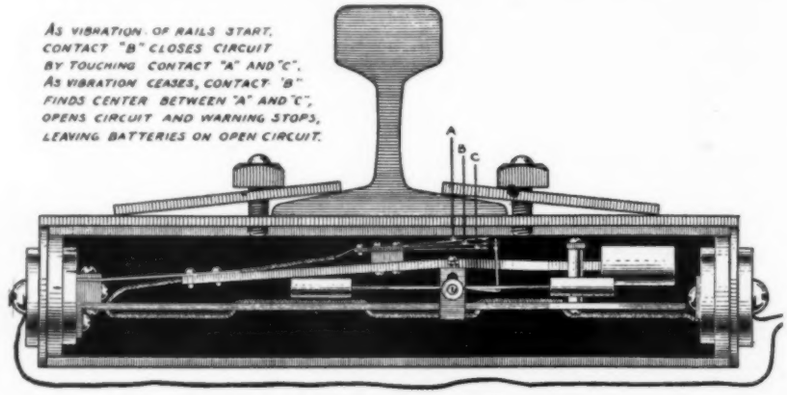
The conduct of the business of this division is carried on under the jurisdiction of Superintendent R. C. Morrison, Trainmaster H. M. Brownie and Chief Dispatcher E. H. McIntosh.

The gross income from the telegraph and telephone system owned by the Swedish Government amounted in 1909 to $458,000. The cost of maintenance was $266,000.

Electric Highway Crossing Signal.

Many of the tragic "crossing accidents" that are daily occurring on our railroads could be prevented by the installation of efficient warning or signal devices.

Such a device has been perfected and is being placed on the market by the Gill-Alexander Electric Company, Denver, Colo., and the record of successful installations reported by the Company is indicative of their simplicity, economy and effectiveness.


AS VIBRATION OF RAILS START, CONTACT "B" CLOSES CIRCUIT BY TOUCHING CONTACT "A" AND "C". AS VIBRATION CEASES, CONTACT "B" FINDS CENTER BETWEEN "A" AND "C", OPENS CIRCUIT AND WARNING STOPS, LEAVING BATTERIES ON OPEN CIRCUIT.
A
B
C

ELECTRIC HIGHWAY CROSSING SIGNAL.

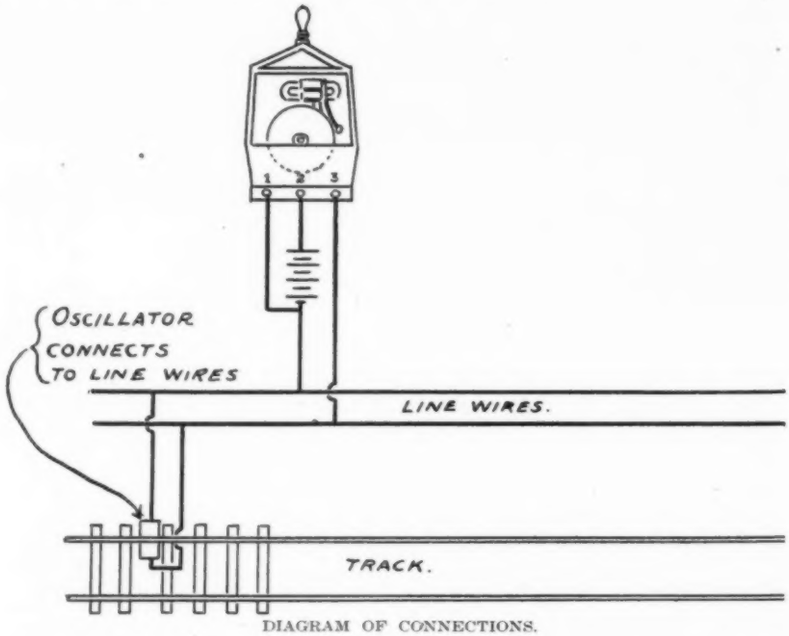


DIAGRAM OF CONNECTIONS.

The operation of the Gill-Alexander signal is as follows: At the crossing proposed to be protected there is placed a highway vibrating gong mounted on a suitable pole. At the base of this pole is placed a weather-proof battery box, the wires from which pass through the magnets of the bell and connect

with a pair of line wires, extending in both directions, parallel with the track, to the end of the protected section.

At each end of the protected section is placed an instrument which is securely fastened to the underside of the rail; this instrument is termed the "oscillator" and is the means of ringing the warning bell at the crossing. A sectional view of this mechanism is shown herewith.

Usually six oscillators are used for an ordinary crossing, placing three on either side of the crossing at intervals of 300 feet. Each oscillator is connected to the line wires, running the wires through wooden trunking from the oscillators to the pole, and each instrument works independently of the others, although all are connected to the same line wires.

When a train is in motion it imparts a vibratory motion to the rails; this vibration causes the oscillator to close the circuit and ring the bell at the highway. The bell rings as long as vibration of the rail lasts. After a train has passed over the protected section, or comes to a stop in the protected section and vibration of rail ceases, the oscillator opens the circuit and the warning stops.

The oscillator is incased in an iron tube which is dust and waterproof, the mechanism being thoroughly insulated from the tube and rail, thereby keeping the batteries on open circuit, except at the moment when the bell is ringing.

The system can also be equipped, if desired, with red lights placed at the bell pole, which will light intermittently when the bell is ringing, in this manner proving to the train crew that warning is being sounded and also indicating whether or not the batteries need renewing.

Such a system as described above has, according to the manufacturers, many advantages, among which may be mentioned the eliminating of bonding of rails, insulating joints, end posts, etc.; ease of installation; overcoming of all complications in track, switches, etc.; elimination of battery leaks; long life and its dependability in all conditions of operation and weather.

EXHIBIT OF THE WESTINGHOUSE COMPANIES AT ATLANTIC CITY.

Westinghouse Exhibit at Atlantic City.

The Westinghouse Companies maintained, at the recent convention of the American Street and Interurban Railway Association, a very comprehensive exhibit, displaying a full line of materials, used by electric railways, that the companies manufacture.

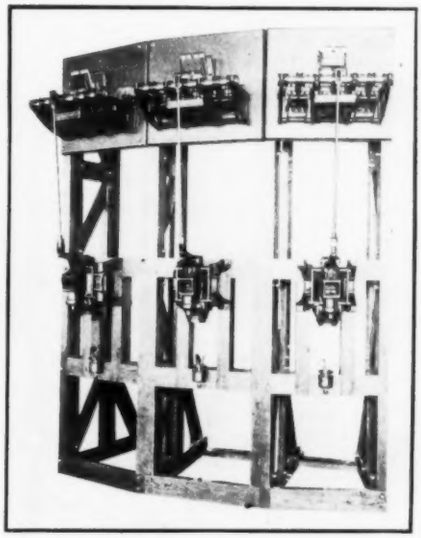
The joint exhibit was conducted by the Westinghouse Electric and Manufacturing Company, the Westinghouse Air Brake Company and the Westinghouse Machine Company, and attracted a great deal of attention by reason of the operating machinery on exhibition. A view of the exhibit is shown above.

A LARGE ALTERNATING-CURRENT CIRCUIT-BREAKER.

BY D. S. MORGAN.

The construction of a circuit-breaker for use on heavy alternating-current circuits presents a somewhat difficult problem to the designing electrical engineer. To insure the distribution of the current uniformly throughout the various parts of the breaker and the avoidance of skin effect, energy losses in heating, etc., requires very skillful designing.

The largest alternating-current circuit-breaker yet built is installed in the worsted mills of the American Woolen Company, at Lawrence, Mass., and protects a 600-volt, forty-cycle turbo-alternator. It is a triple-pole solenoid-operated, type C, Form K-2 breaker built by the General Electric Company, and has a current-carrying capacity of 12,000 amperes continuously without overheating.



12,000-AMPERE CIRCUIT-BREAKER.

If a circuit-breaker for use on heavy alternating-current circuits of 6,000 amperes and over, were built on the lines of usual direct-current construction it would not perform its work satisfactorily and would heat to a dangerous degree in service. To avoid this, special construction must be employed.

In the design of the circuit-breaker in question, a large amount of radiating surface was provided and uniform distribution of the current throughout the various parts was insured by subdividing the contact brushes and the

studs of each pole into six sections, each section insulated from the others. Each pole of the circuit-breaker is operated by a separate solenoid mechanism so connected that the entire triple-pole breaker is controlled by a single control switch on the switchboard panel. The open and closed positions of the breaker are indicated by pilot lamps located at the controlling switch.

To obviate the necessity of opening an arc at the control switch, the circuit of the closing coils is opened by relays located near the circuit-breaker after the latter closes. The circuit-breaker trip coils are opened by auxiliary switches on it, which open when the breaker itself opens. The device is made automatic by the use of current transformers and relays. The circuit-breaker, solenoids and control relays are mounted on specially designed hard-wood supporting framework made to conform to the perimeter of the turbine to which the framework is secured.

The breaker has now been in service for several months and is operating satisfactorily.

Triumph Alternating-Current Generators.

A new line of alternating-current generators has been placed upon the market by the Triumph Electric Company, Cincinnati. These machines are of the stationary armature and revolving field type and are built for either direct connection, for coupling to an engine, or may be belt driven as desired. The sizes range from fifty kilovolt amperes upwards, and may be obtained for single, two or three-phase circuits and for 240, 480, 600, 1,200 or 2,400 volts.

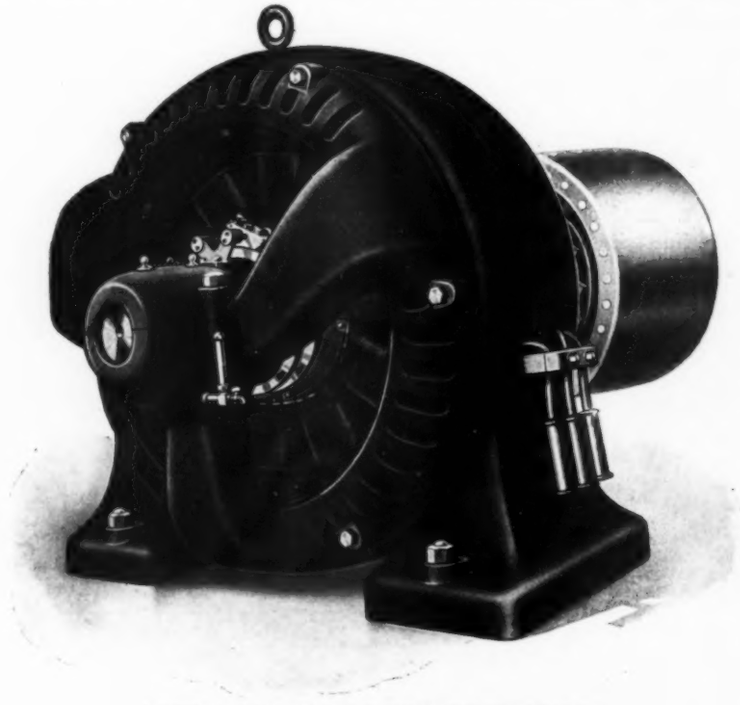
The special features which make these machines noteworthy are the thorough ventilation of all parts and the ability to operate in parallel with machines of other make. It is believed that just these two features will popularize these alternators to a very large extent, and in addition the design and construction are very strong

The usual standard rating of thirty-five and forty degrees centigrade temperature rise have been adopted, and any machine can be furnished for either of these ratings according to the duty it has to perform. Generally speaking a forty-degree centigrade temperature rise will be advocated for machines which have to carry a non-inductive load—while a machine which has to carry an inductive load such as arc lamps or induction motors will be rated on the thirty-five-degree centigrade basis.

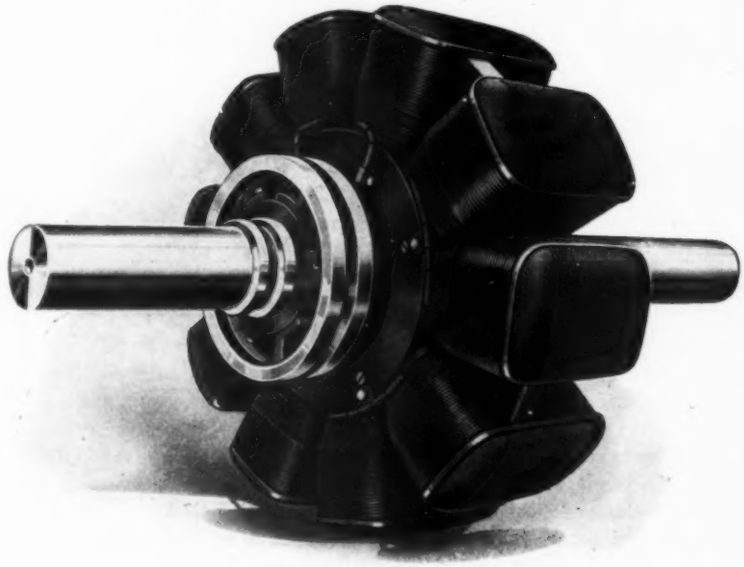
The regulation of these new Triumph alternators is in accordance with the best engineering practice, and will vary from six per cent on a machine with a thirty-five-degree rise to eight per cent with a machine rated at forty degrees temperature rise.

The use of a relatively large amount of copper in both the rotor and stator windings has reduced the copper loss to a minimum. In addition due to the excellent design of the stator, the core losses are comparatively low, so that these machines have exceedingly high efficiencies.

The accompanying illustrations show one of these machines, and it will be noted that the design is particularly compact and pleasing to the eye.



TRIUMPH ALTERNATING-CURRENT GENERATOR.



ROTOR OF TRIUMPH ALTERNATOR.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, OCTOBER 21.—The electrical driving of reversing rolling mills for which it has hitherto been considered the Ilgner patent was the master, has received considerable attention this week owing to the fact that the Court of Appeals has declared this patent invalid for the reason that it has no subject matter. The court held that Ilgner in his patent merely took the Ward Leonard system of control, together with an idea expressed in an earlier patent of Ferranti, and added a flywheel.

Another appeal-court case of interest relates to the use of phospham in the manufacture of metal-filament lamps. The "Z" Electric Lamp Company has a patent for the use of this chemical in order to prevent the blackening of lamp bulbs, and the Bergmann Company of Berlin has been charged with infringing the patent. Messrs. Bergman do not deny that they use it, but claim to use it, as stated heretofore in these columns, with another object in view.

Unlike a good many of their English confreres, the engineers of a number of Scottish electricity undertakings are troubled with unduly large profits, and some trouble is being experienced in disposing of them to everybody's satisfaction. In Glasgow, Edinburgh and Leith this position exists and a general clamor is being made to prevent the accumulation of profits by reducing the charges, instead of distributing the profits for the relief of the rates. In the case of the Glasgow gas undertaking the transfer of profits to the relief of rates has been prohibited by an Act of Parliament.

There has been a smoothing of ruffled feathers at Torquay, and the local tramway company is now being allowed to proceed with the installation of the overhead system in place of the Dolter surface contact system without further protest. It is generally recognized that it is in the best interests of all that the change should be made, and a little less obstinancy on the part of the Council would have saved it and the company some thousands of pounds. A similar agitation for a change is now being conducted at Hastings, where about two miles of the Dolter system are being worked along the sea front.

Some big developments are foreshadowed in London in regard to electrical omnibuses and vehicles generally. Two new companies are proposing to place a large number of vehicles on the streets, and the engineer to the Marylebone Corporation Electric Supply Department is offering to supply energy at one cent per unit. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, OCTOBER 20.—The general council of the Aveyron Department in the south of France is making arrangements for installing an electric railroad system in this region, in connection with the Southern Railroad Company. This latter is to sublet the contract to another company, which will probably be the Giroshoucher firm of Limoges, for the building of the lines. Standard gage will be adopted in order to run the electric railroad in connection with the existing railroad lines and also with the extensive system which the Southern Railroad Company is engaged in constructing in the Pyrenees region and which we already mentioned.

Avignon, on the Rhone, is to have two electric tramways running to the suburban towns of Villeneuve and Chateaurenard. A tramway line will soon be built from Lourdes to Bagneres and from this latter point to Gripp, in the Pyrenees region. The municipal council of Dunkerque has approved the project for a tramway line running to St. Pol on the Channel coast.

It is planned to carry out the Virgljoch electric line in Austria on the suspended system, using a cableway somewhat as in the Wetterhorn line. It starts from a point on the Lana-Meran electric road and has a difference of level of 1,156 meters for a length of two and two-tenths kilometers, the gradient being from fifty-two to sixty-one per cent. From the cableway running between the two points the passenger car will be suspended by means of a rolling carriage. There will be two main cables forming the cableway. According to the present account, the cables are not stretched in a single span as in the Wetterhorn plant, but run on iron poles which are spaced to give a 100 to 140 meter span for the cable. A fifty-horsepower direct-current motor working on 550 volts operates the cable drum for the traction cable, this being attached to the rolling carriage. Current comes from the Lana electric plant over a 3,000-volt three-phase line and at the traction line there is a substation containing a 125-horsepower rotary-converter set. The electrical work will be carried out by the Union Electric Company of Vienna. Another recent project in the mountain region of Austria relates to a combined automobile and electrically-operated cable road which will allow tourists to reach the heights of the Triglav, this being a much-frequented site. An automobile omnibus of eighty-horsepower will run up as high as Bolo-Polje, and from this point a cable incline is to take the passengers to the summit. At the first-named point will be erected an electric plant for supplying current to the cable incline.

Among the recent German projects I note the electric road which will be built from Cologne to Porz and Beuel. It is intended to use the power of three different streams in Baden in order to operate a hydraulic plant, these being the Nagold, Ems and Würm. In this way it is expected to secure 60,000 horsepower. A turbine plant will be erected at the locality of Kupferhammer. The town of Husum and the neighboring district are to be supplied with current from a 5,000-horsepower station. The Taunus electric plant, which is operated by the Körting Electric Company of Berlin, is to furnish current for Ober-Reifenberg and for the Feldberg region.

Starting from Basle, Switzerland, the Alsacian Jura region will be reached by an electric line. The first part of the line comprises the already existing Bersigtal road, which will be extended to Rodersdorf. From here a new section will run to Vendlincourt and will thus join the Bonfoler road ending at Pruntrut. A. DE C.

MEXICO.

(Special Correspondence.)

MEXICO CITY, MEX., OCTOBER 28.—The Yoquivo Development Company is developing water power with the view of installing a hydroelectric plant at its mines in Yoquivo, Chihuahua. The Company has been operating the machinery of its mines and mills by electric power, generated by steam, but as the capacity of the plant was inadequate to the demands that were made upon it, it was decided to replace it with a hydroelectric plant. The new plant will provide power for operating the mills at double their present capacity and is also to operate the drills and ore cars in the mines.

The Compania Minera Oro Nolan of El Oro, will install a complete electrical equipment for the purpose of operating its machinery. The present steam compressor will be equipped with a seventy-five-horsepower motor and a number of smaller motors will be installed for the crushers, ventilators and other machinery. The large pump will be driven by a 100-horsepower motor. Transformers and a complete lighting equipment will also be installed. The Company will obtain its power from the transmission line of the Mexican Light and Power Company of The City of Mexico.

Roger B. Chase will install a 100-horsepower hydroelectric plant at his mines near Canelas, Durango, for the purpose of providing power for operating the machinery of his property, including the reduction mill. He will construct a storage reservoir and canal for the purpose of obtaining the necessary water power for the proposed plant.

The Necaxa dam, which has just been finished by the Mexican Light and Power Company, is said to be the largest hydraulic fill dam in the world. It is larger than the famous Gatum dam of the Panama Canal that is now being constructed. The construction of the great Necaxa dam required the use of 5,000,000 tons of rock and 20,000,000 cubic yards of earth. It forms a reservoir which has a capacity of 24,000,000 cubic meters of water or 6,000,000,000 gallons. It forms one of a series of five reservoirs which contain the water supply for operating the hydroelectric plants of the Mexican Light and Power Company. The transmission lines of the company run to the City of Mexico, the mining camp of El Oro, Puebla and Pachuca.

The concession which was granted by the state government of Guanajuato to George W. Bryant and associates for the construction of a long-distance telephone system and local telephone exchanges has been transferred to the Compania Telefinica de Guanajuato, S. A., which has its headquarters there. The Company has a capital stock of $900,000 which is owned by Fernando Pimentel y Fagoaga, president of the Mexican Central Bank of the City of Mexico; Jose P. Bustamante, George W. Bryant, Juan Castelazo and Martin Garza. At a meeting of the stockholders Mr. Pimentel was elected president and Mr. Bustamante, vice-president. The company will soon start the construction of several hundred miles of long-distance telephone lines. These lines will radiate from Guanajuato in all directions, extending to many towns and mining camps of the state. D.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

POWER PLANT AT MARBLE FALLS, TEX.—A new hydroelectric plant which is to have an ultimate capacity of 30,000 horsepower is being erected at Marble Falls, Tex., by C. H. Alexander of Texas, and his associates. The plant, which is on the Colorado

River, is of unique design especially as regards the dam. This is built on a concrete foundation and is four stories in height, each story being divided into a number of rooms or chambers. The chambers may be opened in times of flood, allowing the water to pass through. The electric power of the plant will be transmitted to a number of towns and cities within a radius of 150 miles, among them being San Antonio, Waco, Austin, Temple, Belton, Georgetown, Llano, San Marcos, Burnet, Taylor, Hutto, Bastrop, Lockhart and Lampasas. It will also provide power for manufacturing plants and other purposes in Marble Falls. H.

ELECTRIC POWER FOR SALT RIVER VALLEY.—The installation of a great hydroelectric power plant near Tempe, Ariz., to be operated in connection with the large irrigation and land reclamation enterprise that has been established by the government, is now said to be assured. The farmers of the Salt River Valley have agreed to advance $900,000 within the next two years for the construction of the proposed plant. It is estimated that the sale of electric power from the plant will return to the water users who will contribute to its installation, about $200,000 per annum. L. C. Hill, supervising engineer of the United States reclamation service, is giving the hydroelectric project his attention and he reports that good progress is being made with the preliminary arrangements. The farmers of the valley will not begin making repayment to the Federal Government of the $8,000,000 that was expended in the construction of the great reclamation dams at Roosevelt and Granite Reef and the attending systems of canals for another two years, and by that time it is expected the prospective hydroelectric plant will be a reality. D.

COMMISSION NEWS FROM NEW YORK.

(Special Correspondence.)

The Public Service Commission of New York has in addition to the order requiring the New York Telephone Company to file a schedule showing the number of pay stations in the city of New York, ordered every telephone company under its jurisdiction to file schedules before November 15. These must show by each exchange separately those of its patrons or subscribers who are receiving telephone service of any character at rates or charges which vary or differ in any respect from the standard rates adopted and now in force for contracting new business.

The Commission has also ordered that all telephone corporations under its jurisdiction file on or before December 1, schedules showing all rates, rentals and charges for services of each and every kind by or over its line or lines between points in this state and between each point upon its line and all points upon every line leased or operated by it and all points upon the line of any other telephone corporation whenever a through service or joint rate shall have been established between any two points.

Such schedules are required to show also all charges and all privileges or facilities granted or allowed and any rules or regulations or forms of contract which may in any wise change, effect or determine any or the aggregate of the rates, rentals or charges for the service rendered.

The Public Service Commission, Second District, has approved of an agreement whereby the Hornellsville Electric Railway Company, Hornellsville & Canisteo Railway Company and Canisteo Valley Electric Railway Company are consolidated into one company known as the Hornell Traction Company. The new company is authorized to issue common capital stock to the amount of $120,000.

The Commission has granted its first permission for capitalization in connection with the telephone companies under its jurisdiction. The Commission has consented and approved of the issue of consolidated first mortgage five per cent gold bonds of the Auburn Telephone Company in the amount of $200,000 and divided into two denominations of $100 and $1,000, respectively. Provision is made that the holders of the bonds of the denomination of $1,000 be given an opportunity to exchange their bonds to those of the denomination of $100. Bonds are to be issued to retire outstanding bonds.

COMMISSION NEWS FROM MARYLAND

(Special Correspondence.)

The Public Service Commission of Maryland on October 24 began its hearing on the application of the Chesapeake & Potomac Telephone Company to establish new rates. Bernard Carter and T. H. Bethell presented the company's side of the matter to the commission. The three points to be considered were: (1) Whether the company was under obligation to furnish grounded circuit service; (2) Whether a flat rate service should continue on the basis of $125 per year for unlimited use; (3 Whether the new rates for message service are just, and if not, wherein they shall be revised.

Mr. Bethell, in his testimony, stated that there are only 820 unlimited business telephones in Baltimore, against a total of 41,755 telephones in the city on October 1 last. He declared in the course of his testimony that eighty-three per cent of the users of unlimited telephones pay more through a flat-rate system than they would if they had limited service and used only the same number of calls. He said that eighty-three per cent of the users of business telephones pay less than $50 a year for their service.

A second hearing is to be held, the date for which has not yet been set.

LIGHTING AND POWER.

(Special Correspondence.)

TWIN VALLEY, MINN.—Herman Klemetsrud has purchased a steam outfit for his electric-light plant. C.

CLINTON, IOWA.—The Commercial Club has taken bids for the installation of curb light on Second Street. C.

RED LAKE FALLS, MINN.—The Red River Power Company is installing machinery for an all-day service at the electric-light plant. C.

RUSH CITY, MINN.—Herman Anderson is considering the installation of an electric-light plant on the site of the old Diffenbacher mill. C.

SWITCHBACK, W. VA.—The Pocahontas Consolidated Coal Company has awarded contracts for the erection of a $50,000 electric power plant.

MARSHALLTOWN, IOWA.—The Council will receive bids on machinery for the development of the water power at the Center Street dam. C.

ANOKA, MINN.—About $60,000 is being expended by the water, light and power commission on new machinery, repairs and the erection of a new power house. C.

KEEWATIN, MINN.—The Council has taken bids for the installation of an electric-light plant and power house. It is also proposed to put in curb cluster lights. C.

FOREST GROVE, ORE.—The City Council has granted a twenty-five-year franchise to A. Welch, of Portland, who recently purchased the Haines electric power plant.

JONESBORO, IND.—A pole line and electric-light equipment will be installed in this place. The current will be transmitted from Marion, a distance of twelve miles. S.

WILMINGTON, DEL.—The Kennett Electric Light plant and the property of Chester County Electric Company have been sold to a syndicate of bondholders for $10,000.

DARLINGTON, WIS.—The power house of the Darlington Electric Light & Power Company was damaged by fire about $5,000. The loss was fully covered by insurance. C.

O'NEILL, NEB.—The contract for the construction of an electrict-light plant has been let to Desimple & Johnson. It will be a one-story brick building, 110 by 50 feet in size. C.

LYONS, N. Y.—The Safferson & Weisberg Company, whose new factory building on Geneva Street is nearing completion, has decided to install a lighting and power plant of its own.

ALLERTON, IOWA.—A. Mardis, of Corydon, Iowa, secured the contract for the erection of a new building for the light plant. It will be of brick, 42 by 44, and will have a concrete foundation. C

PEARSALL, TEXAS.—The Pearsall Gin Company has sold its electric light plant to the Pearsall Water, Light and Ice Company, and the acquired plant will be merged with that of the purchasing company. D.

CADILLAC, MICH.—A Manistee man has purchased 140 acres of land at Interlochen for water power rights. Wexford, Buckley, Mesick, Harrietta, Glengarry and Interlochen are to be furnished with light.

BOGALUSA, LA.—The Bogalusa Public Service Corporation has been incorporated with a capital of $600,000 to operate the water works, an electric light plant, electric railway, sewer system, etc., in this city.

MARION, ILL.—The Marion Electric Light and Street Railway Company has certified to a change in name to the Marion Light, Power and Water Company and increased its capital stock from $20,000 o $100,000. Z.

PRETTY PRAIRIE, KAN.—J. J. Siebert has secured a franchise to establish an electric light plant, which will soon be erected here. The franchise provides for a charge of seventeen and one-half cents per kilowatt hour.

PRINCETON, IOWA.—An ordinance has been passed granting to the town the right to establish an electric light plant to supply current for public and private lighting. The cost of the plant is not to exceed $730.00.

GEORGETOWN, TEX.—The electric light plant and water works system here which were recently acquired by the city, bonds to the amount of $45,000 having been voted by the people, will be enlarged and extensively improved. D.

PINE RIVER, MINN.—A franchise has been granted by the village council to T. L. Arvig for the installation of an electric-light plant. A reinforced concrete dam, to furnish 300 horsepower, is being constructed by Webber & Hill. C.

BUTLER, ILL.—The Hillsboro Electric Light and Power Company has begun a survey for its line to Butler. In addition to lighting residences and the village streets the company will supply power for the Munday Elevator Company. Z.

CLINTON, IND.—The twin collieries of the Bunsen Coal Company that are being built south of Clinton by the United States Steel Corporation will be one of the greatest plants of the kind in the world and will employ an immense amount of electrical equipment. S.

SAFFORD, ARIZ.—The Gila Valley Electric, Gas and Water Company is constructing a water storage reservoir that will have a capacity of 60,000,000 gallons in the Fry canyon of the Graham mountains. The work involves the driving of a tunnel 360 feet long through solid rock. D.

CONCORD, N. H.—The Central New Hampshire Power Company has been incorporated to generate electric power from the Blackwater River. The principal incorporators are Nathaniel E. Martin, Edwin D. Clough, Edward C. Crosby and Dennison Cowles, all of Brattleboro, Vt.

PORTERVILLE, CAL.—Main Street in this city is soon to be furnished with decorative lighting system. Each part is to have either three or five 100-watt tungsten lights. The city has agreed to pay the cost of their maintenance after they have been installed at the cost of the merchants.

EAST CHICAGO, IND.—The Northern Indiana Gas & Electric Company is completing a new power house in this city and is at work building a pole line from the plant to Chesterton, Porter and Michigan City. This territory will be supplied with unlimited power and light when completed. S.

STOUGHTON, WIS.—Plans are being made for an ornamental street lighting system in this city, the subject having been brought up at a business meeting a short time ago. The suggestion was made that the city should spend $3,000 to remove the present poles and install ornamental light. It now seems likely that this scheme will be carried out.

MARION, IND.—The Indiana Supreme Court has decided that the Marion Electric Light Company can be compelled by mandamus to furnish electric light for the city library building free of cost where the company derived its franchise from a preceding company, even though the library building was not constructed at the time the original franchise was granted. S.

SCRANTON, PA.—Preparations are being made by the Scranton and Binghamton Railroad Company to enter the light field in the towns along its line, and within sixty days it expects to supply electric light to Clark's Green, Clark's Summit, Dalton, Waverly, Factoryville and other towns. The new machinery will include two motor-driven generators, each having a capacity of 100 kilowatts.

LEXINGTON, VA.—Recommendations have been made by a special committee for the erection of a 200-horsepower steam plant in addition to the present water power plant, in order adequately to provide lights for the town. Six months is the time named in which the improvement shall be made. The complaint about the present lighting is due to the drought, and the consequent extremely low water in North River, which furnishes the power for the plant.

OLIVET, MICH.—E. M. Enos has petitioned the City Council for a contract to construct and operate an electric light plant in this place. Mr. Arnos represents a stock company capitalized at $15,000, most of the stock being owned by local people. The power dam which is now being used by the roller mills will be reconstructed to produce the power needed. It is probable that work will soon be started and that Olivet will be electric lighted within nine months.

BRONSON, FLA.—A mortgage has been filed for $200,000 on the property of the Florida Power Company to Augustus S. Peabody, of Chicago. The funds thus raised are to be used for the purpose of constructing a dam across the Withlacooche River, in the southern part of Levy County, which when completed will be used for furnishing electric power for several cities in Levy and adjoining counties. The power is also to be used in the phosphate industry.

TEXAS CITY, TEX.—Captain A. B. Wolvin of Duluth, Minn., president of the Texas City Transportation Company authorizes the announcement that an appropriation of $500,000 has been made by that company for the installation of an electric light and power plant here and other public utilities for the town. The power plant will be of sufficient capacity to provide electric power for the electric loading and unloading cranes upon the wharves, the carrying system of the warehouses and factories and industries of the town and adjacent territory. D.

NEW RICHMOND, WIS.—The New Richmond Roller Mills Company has completed the installation in this city of a steam electric plant to run as an auxiliary to the twin water-power plants on Apple River at Huntingdon. It includes a 525-kilowatt steam-turbine generating set. The installation of the steam plant was made necessary by the low stage of water prevailing on Apple River this season. Practically every wheel in New Richmond, in mills, shops, elevators and factories, save those of the saw and planing mills, is turned by electricity from Apple River.

FORT WORTH, TEX.—One of the most important transactions in the history of electrical development in Texas has just been ratified by the city commission of Fort Worth. It involves the purchase by J. R. Nutt of Cleveland, Ohio, of the electrical franchise and other holdings of the Fort Worth Light and Power Company and the electric properties of the Fort Worth Gas Company. The contract by which he acquires these properties also provides for the immediate construction of a central hydroelectric plant with a capacity of 22,000 horsepower and other large improvements which call for a total expenditure of approximately $2,000,000. D.

ELECTRIC RAILWAYS.

(Special Correspondence.)

LINCOLN, NEB.—Electric lines to Auburn, Omaha and a group of towns lying to the northwest of Lincoln have recently been projected. C.

MADISON, WIS.—A franchise has been granted to the Chicago & Wisconsin Valley Street Railway Company to maintain a railway. C.

DES MOINES, IOWA.—The Greater Des Moines Committee is raising $200,000 towards the construction of the Red Oak interurban. C.

LOS ANGELES, CAL.—The Pacific Electric Railway Company will soon extend its new La Habra line two and one-half miles further east into the region beyond Yorba Linda. A.

LOS ANGELES, CAL.—The Los Angeles Railway Company has petitioned for a railway through the Broadway tunnel so that the Highland Park cars may reach Broadway, reducing the running schedule. A.

SPOKANE, WASH.—E. P. Spalding, S. A. Skinner and others have incorporated the Spokane, Portland & Northern Railway with a capital of $10,000,000 to construct an electric or steam road to Bridgeport. C.

HANNIBAL, MO.—An interurban line from Kirksville to Hannibal was urged at a meeting of the Hannibal Commercial Club, at which representatives from Bethel, a town on the proposed route, were present. Z.

DES MOINES, IOWA.—The Fort Dodge, Des Moines & Southern road has about fourteen miles of road prepared for interurban service and expects to have the rmaining twenty-seven miles of its system completed by December 1. C.

MILWAUKEE, WIS.—Directors of the Milwaukee Western Electric Company, have authorized a $5,000,000 mortgage and $2,500,000 bond issue for constructing a road to Fox Lake, with a branch from Sussex to several summer resorts.

TRENTON, N. J.—The Trenton-Mercer County Traction Company has been incorporated with a capital stock of $10,000. Stockholders are George W. MacPherson, Rankin Johnson, and Oscar T. Crosby. The local agent is Peter E. Hurley.

OAKLAND, CAL.—The Southern Pacific Railway Company has commenced work on electrifying the Seventh Street line here. The company plans to spend about $200,000 on street paving alone and about $100,000 in straightening the street. A.

PORT TOWNSEND, WASH.—Chas. C. Gentry, Walter Strange and Arpad Tokay have incorporated companies with a capital of $7,000,000 for the construction of Boyes monorail railways to Bellingham, Mount Vernon, Irondale and Port Angeles. C.

MINNEAPOLIS, MINN.—The Electric Short Line, Earl Luce, president, expects to start the operation of its road to Medicine Lake by the end of November. Next summer it is proposed to extend the line to Lake Minnetonka, Watertown and also to Winsted, Minn. C.

WILKESBARRE, PA.—The Wilkesbarre Traction Company will not commence work on the new extension of the lines on Walnut and Division streets, Kingston, until next spring. The Company recently agreed to pay $16,000 for the right to lay tracks on the above-mentioned streets.

SOUTH BEND, IND.—The Chicago, South Bend & Northern Railway Company has approved the plans made for a new passenger, freight and car house. The structure will be of brick 60 by 120 feet and will include the old machine shop remodeled and made a part of the new building. S.

GARY, IND.—The application by the promoters of the Seaman Interurban Railroad for a franchise to enter Gary has been passed on favorably by the City Council. The franchise provides that the cars are to be in operation to the Ridge road within sixty days. The track-laying is progressing rapidly. S.

LOS ANGELES, CAL.—The Los Angeles Railway Company has changed the last word of its name to "corporation" and increased the capital stock from $5,000,000 to $20,000,000. This corporation already operated 240 miles of trackage and this is to be increased by 100 miles within two years. A.

FAIRBURN, GA.—The Fairburn & Atlanta Railway & Electric Company, of which W. T. Roberts is president, was given authority by the Railroad Commission of Georgia to issue $75,000 common stock and $50,000 first mortgage bonds. Construction from Fairburn to College Park is steadily progressing.

MINNEAPOLIS, MINN.—The Dan Patch Air Line has made formal application to the City Council for a franchise permitting it to construct its lines into the city to some point near Lake Street and Nicollet Avenue. Construction work already has been finished to the city limits at the end of Nicollet Avenue. Z.

INDIANAPOLIS, IND.—The work of grading the nine miles of road for the Beech Grove Interurban Company has been almost completed. The rails will arrive soon and track-laying will be begun. The company is building car barns and a substation at Beech Grove. The road will be in operation by January 1. S.

FT. WAYNE, IND.—Bond has been filed by the promoters of

the Ft. Wayne & Toledo Electric Railway, who are building a road from Ft. Wayne to Bryan, O., in compliance with a franchise granted to the Company to build through Allen County. The promoters say that much material and equipment has been bought.

PRINCETON, IND.—The Southern Indiana Railway Company has officially announced that it will rebuild its machine shops at this place. The new shops will be equipped with a large amount of electric machinery and devices. S.

FT. WAYNE, IND.—The Ft. Wayne & Toledo Electric has filed its bond in acceptance of the franchise granted by the commissioners of Allen County. Announcement is made that much equipment has been purchased and that construction work will begin on a large scale. H.

INDIANAPOLIS, IND.—In default of interest payments L. F. Smith and G. A. Buskirk, trustees for the mortgagees, have filed suit against the New Castle & Toledo Electric Railroad to foreclose the mortgage. The road runs from New Castle to Indianapolis, a distance of thirty miles. The equipment is new and the road is doing a good business. S.

WARSAW, IND.—At the annual meeting of the directors of the Winona Traction Company, H. J. Heinze, of Pittsburg, was re-elected president; W. D. Frazier, of Warsaw, vice-president, and H. C. Anderson, of Pittsburg, secretary. The old directors were re-elected, together with Eward Beyers, of Warsaw, who was named to fill a vacancy on the board. S.

MONTICELLO, IND.—The Northwestern Indiana Interurban Railway is making good progress in the construction of a road from this city to Hammond. The grading and bridging has been completed from Chicago Heights to Dyer, and work will begin at once on the division from Chicago Heights to Hammond. Capitalists are quite willing to take an interest in this road. S.

STOCKTON, CAL.—The Tidewater & Southern Railway Company, known as the Stockton-Turlock road, announces that it will operate cars between Stockton and French Camp by December 15th. The electric road will use the roadbed of the old Corral Hollow steam line running out of Stockton to a point near French Camp. The company will soon begin grading. A.

SAN ANTONIO, TEX.—The Terrell Hot Wells Company which is building the new town of San Jose, five miles from this city, is negotiating with the International & Great Northern Railroad company with the view of electrifying the tract of the latter road between San Antonio and San Jose. It is announced that if this is not done the electric railway system of San Antonio will be extended to San Jose. D.

SPRINGFIELD, ILL.—The Central Illinois Traction Company has filed articles of incorporation with the Secretary of State. The object of the Company which has a capital stock of $20,000 is to construct a railroad from Springfield, Ill., to Nashville, Ill., with branch lines. The incorporators are Isaac A. Smith, George W. White, Noble E. McMillan and Alfred L. Lynch, all of St. Louis, and James W. Gullett, H. B. Williams, John B. Constant, Oscar Ansell and William J. Barrett. Z.

SPRINGFIELD, ILL.—Articles of incorporation have been filed with Secretary of State Rose, by the Fox & Illinois Union Railway Company with its principal offices at Aurora. The object of the Company which has a capital stock of $25,000 is to construct a railway from Yorkville to Morris with connecting lines to Dwight and Sandwich. The incorporators and first board of directors are John Meredith, Joshua Rhodes, Frank Zimmerman, Henry H. Evans and Ralph C. Putnam, all of Aurora. Z.

HOPKINSVILLE, KY.—Rapid progress is being made with the preliminary work of the Kentucky-Tennessee Traction Company, organized to build an interurban railway from Hopkinsville to the Western Kentucky Insane Asylum; thence along the Nashville turnpike by way of the Sulphur and Mineral Springs, to Pembroke, Trenton and Guthrie, Ky. The Company intends to extend the line to Nashville, Tenn., and later to coal fields in Christian and adjoining counties north of Hopkinsville, and ultimately it will doubtless reach Evansville, Ind., on the Ohio River.

SPRINGFIELD, ILL.—Articles of incorporation have been issued by the Secretary of State to the Alton and Mississippi River Belt Railway and Transportation Company, with its principal office at Chicago. The capital stock of the company is $25,000. The object is to construct a railway from a point in St. Clair County on the Eastern inner harbor line of the Mississippi River, opposite the city of St. Louis, through St. Clair and Madison counties to the city of Alton. The incorporators and first board of directors are John W. Bissell, Julius H. Gusser, Henry L. Stern, Herbert J. Friedman and Michael Feinbery, all of Chicago. Z.

JOLIET, ILL.—The McKinley system announces that it will begin construction work on its interurban line from Morris immediately after the City Council passes an ordinance granting the Joliet & Southern Traction Company the right to transfer its franchise rights in Desplaines, McDonough and Harrison Streets to the Chicago, Ottawa & Peoria Railway Company, the McKinley subsidiary. The portion of the franchise which the latter company agrees to take over requires the building of a new bridge over the river and canal at McDonough street. The McKinley Company is to get a forty-six year privilege if the council passes the ordinance. Z.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

JOLLEY, IOWA.—The Central Mutual Telephone Company is erecting an exchange. C.

GRINNELL, IOWA.—The Interior Telephone Company has been granted a franchise. C.

CLEAR LAKE, IOWA.—Farmers here are organizing an independent telephone company. C.

ROSS, N. D.—The Queen City Telephone Company will shortly build a line to Powers Lake. C.

HAMPTON, IA.—The Iowa Telephone Company has begun the erection of an exchange building. P.

GONZALES, TEX.—The Gonzales Telephone Company is to establish a switchboard with 1,000 drops. P.

SERGEANT BLUFF, IOWA.—The Woodbury County Telephone Company has petitioned for a franchise. C.

WISNER, NEB.—The Eastern Nebraska Telephone Company has been chartered with a capital of $10,000. P

BIG CABIN, OKLA.—The Big Cabin Telephone Company has been incorporated with a capital stock of $5,000. P

JONESBORO, ARK.—The Home Telephone Company will extend its system from Jonesboro to Marked Tree. P.

PLATTSBURG, MO.—The Home Telephone Company, of St. Joseph, Mo., has a telephone franchise for this point. P

CLEARBROOK, MINN.—The Garden Valley Telephone Company will build an exchange and extend its lines to this town. C.

MILWAUKEE, WIS.—The Wisconsin Telephone Company is building a new through line to Madison by way of Lake Mills.

MARSHALLTOWN, IOWA.—The Merchants, Mechanics & Farmers Telephone Company has been formed with a capital of $75,000.

STEVENSON, ALA.—The Southern Bell Telephone & Telegraph Company is installing new equipment and cables in this place.

NEW HOLLAND, ILL.—The New Holland Telephone Company has certified to an increase in capital stock of from $2,500 to $10,000. Z.

COIN, IOWA.—The telephone companies are planning on considerable improvements, including moving the switchboard to their new building. C.

GRAND ISLAND, NEB.—The Nebraska Telephone Company has let the contract for the erection of a three-story brick, modern exchange building on Walnut Street. C.

AVON, MONT.—The Avon Local Home Telephone Company, capital $10,000, has been organized and will install a modern system. Construction will be started at once. C.

BOONE, IOWA.—The local plant of the Boone County Telephone Company has absorbed the local exchange of the Central Union Telephone Company. The Bell line will continue the long-distance service. Z.

HUNTSVILLE, ALA.—The Southern Bell Telephone & Telegraph Company will expend about $12,000 improving the Huntsville system. Much cable is to be installed and equipment sufficient for 2,500 phones will be added. B.

BUFFALO, N. Y.—The National Police Signal Company, of Buffalo, to install, manufacture and operate a signal system in the city of Buffalo, has been incorporated. The capital stock is $100,000 and the directors are Augustus F. Scheu, John F. Nagel, Louis W. Miller, John A. Nolan and Solomon F. Scheum, all of Buffalo. T.

SPARTANSBURG, S. C.—The conference announced recently to be held in this city between the local Bell Telephone Company and a committee from the chamber of commerce was duly called, and the telephone officials and business men held a lengthy discussion relative to the latter's petition for improvements in the service. The city asked for lower rates and better service, while the company replied with the affirmation that it was ready to install the central-energy system and make the service strictly up to date, but would expect to increase rates on a basis of fifty cents per month per station. It has been declared that an appeal to the State Railroad Commission may be made by the City later on, the conference resulting practically in no nearer solution of existing problems than had been reached before. L.

SANTA ROSA, CAL.—With the completion of arrangements for the issuance of $300,000 bonds by the Clear Lake Consolidated Telephone Company a big merger of telephone lines has been effected. This company, recently organized, has taken over all the properties, rights and franchises of the Clear Lake Telephone and Telegraph Company, operating lines in Lake, Mendocino and Napa Counties; the Northwestern Telephone and Telegraph Company, operating exchanges and lines in the Sonoma Valley, along Russian River and other points in this county; the Gold Ridge Improvement Company, operating lines in the Gold Ridge section of this county, and the plant of the Northwestern Electric Company. The systems are connected with the main system at Ukiah, Cloverdale, Santa Rosa, Sonoma, Sebastopol and other points. A. H. Spurr, of this city, is the president of the company, and Fred L. Wright, also of this city, the secretary and general manager. A.

ELECTRICAL SECURITIES.

After what has been an unusually long period of rising prices it might be expected that a considerable reaction would take place. On the contrary, there was, generally speaking, very little change, and the average price was only slightly lower than a week ago. On the reaction which was noted in the midweek, business became very dull and showed little activity during the last few days. The important news of the week was the quarterly Steel report, the increase in the dividend rate of the Consolidated Gas Company, the annual report of the Union Pacific and the placing of $10,000,000 of short-time notes of a New York Central subsidiary in Paris.

George W. Linch, receiver of the Second Avenue Railroad Company, announces that the principal and interest on the Second Avenue Railroad general consolidated mortgage five-per-cent bonds, due November 1, will be paid upon presentation at the office of the Guaranty Trust Company, of New York.

Bertron, Griscom & Jenks are offering at ninety-four and one-half and interest the unsold portion of the issue of $1,200,000 first and refunding five-per-cent bonds of the Colorado Springs Light, Heat and Power Company, controlled by the Susquehanna Railway Light and Power Company, the latter in turn controlled by the United Gas and Electric Company, of New Jersey.

The reorganization committee of the Washington, Baltimore & Annapolis Electric Railway Company announces that over half the bonds of that company and about an equal number of the bonds of the Baltimore Terminal Company have been deposited with it, as well as a considerable amount of the stock of the former company.

At the annual meeting of the Chicago Railways Company Frank L. Hupp, secretary of the company; William H. Clark, W. W. Jones, and John Reese were elected directors, to succeed Hempstead Washburne, W. N. Eisendrath, F. H. Rawson, and John W. Gary. Other members of the board were re-elected. The company's financial statement will be rendered soon after the close of the fiscal year, January 31.

DIVIDENDS.

American Gas and Electric Company, regular dividend of one and one-half per cent on the preferred stock payable November 1 to stock of record November 25.

New Orleans Railway and Light Company, dividend of two and one-half per cent on the preferred stock, payable January 16 to stock of record December 31.

Portland Railway, Light and Power Company, common quarterly dividend of one per cent.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

NEW YORK.

	Oct. 31.	Oct. 24.
Allis-Chalmers common	9	10
Allis-Chalmers preferred	32½	33½
Amalgamated Copper	68¾	71
American Tel. & Cable	84	84
American Tel. & Tel.	140⅞	139½
Brooklyn Rapid Transit	77¼	78¾
General Electric	155	154¼
Interborough-Metropolitan common	22	22⅝
Interborough-Metropolitan preferred	57¾	58⅞
Kings County Electric	123	123
Mackay Companies (Postal Telegraph & Cables) common	92	93
Mackay Companies (Postal Telegraph and Cables) preferred	73½	74
Manhattan Elevated	142	143½
Metropolitan Street Railway	*18	*18
New York and New Jersey Telephone	103	103
Pacific Tel. and Tel.	40½	42¼
U. S. Steel common	78¼	79¼
U. S. Steel preferred	119⅝	119⅞
Western Union	72	72½
Westinghouse common	73½	73⅞
Westinghouse preferred	120	120

*Last price quoted.

BOSTON.

	Oct. 31.	Oct. 24.
American Tel. & Tel.	140¾	139¼
Edison Elec. Illuminating	266	264
General Electric	155	154¼
Massachusetts Electric common	19¼	20
Massachusetts Electric preferred	84¾	88½
New England Telephone	133½	135½
Western Tel. & Tel. common	17	17
Western Tel. & Tel. preferred	85	88

PHILADELPHIA.

	Oct. 31.	Oct. 24.
American Railways	43	43
Electric Company of America	11⅝	11½
Electric Storage Battery common	49	49
Electric Storage Battery preferred	49	49
Philadelphia Electric	15½	15⅝
Philadelphia Rapid Transit	16¼	18⅛
Philadelphia Traction	81	82
Union Traction	39½	42¼

CHICAGO.

	Oct. 31.	Oct. 24.
Chicago Railways, Series 1	77	73
Chicago Railways, Series 2	19¼	18⅜
Chicago Subway	5	5¼
Chicago Telephone	121	120
Commonwealth Edison	115	115
Metropolitan Elevated common	20	20
Metropolitan Elevated preferred	62	69
National Carbon common	127	126½
National Carbon preferred	118½	119

PERSONAL MENTION.

E. W. WINTER, president of the Brooklyn Rapid Transit Company, is visiting the Northwest.

GEORGE W. PRINGLE has been appointed manager for the Interstate Telephone Company at Peoria, Ill., succeeding C. F. Hixon, resigned.

C. H. EWING has been appointed superintendent of the Atlantic City Railroad and of the Cape May, Delaware Bay & Sewells Point Railroad, vice A. G. McCausland, resigned.

A. BEMENT of Chicago addressed the students and faculty of the College of Engineering, of the University of Illinois on Friday, October 21, his topic being "The Practical Uses of Coal Analysis."

PROF. C. T. KNIPP of the physics department of the University of Illinois is in Europe on a year's leave of absence. He will spend the greater part of the year in Cambridge studying under Prof. Sir J. J. Thomson.

CHARLES K. MOHLER, consulting engineer, has opened offices in the McCormick Building, Chicago. Mr. Mohler is prepared to make reports on traffic and transportation and to give valuations on steam and electric railways.

V. C. GILPIN has been appointed general sales manager for the Eastern Flexible Conduit Company, of Brooklyn, N. Y. Mr. Gilpin was, a short time ago, also chosen as master of transportation of the National Electrical Contractors' Association.

FREDERICK A. DELANO, President of the Wabash Railroad Company, addressed the students and faculty of the College of Engineering of the University of Illinois on Tuesday, October 25. His subject was "The Railway as a Profession."

PROF. A. N. TALBOT, of the College of Engineering of the University of Illinois, is serving as a member of an expert commission which is engaged in inspecting and reviewing the work of construction of the new City Hall of Chicago.

DR. KARL GEORG FRANK announces that his offices in New York have been moved to the West Street Building. Dr. Frank represents Siemens & Halske, and Siemens Schuckertwerke, two of the best known manufacturing concerns on the continent.

D. McFARLAN MOORE, inventor of the Moore Light, delivered an address in the physical laboratory of Johns Hopkins University on October 28 before the Baltimore Section of the American Institute of Electrical Engineers. His subject was "The Development of the Moore Vacuum-Tube Light."

WARREN T. DURFEE of Decatur, Ill., has been appointed traveling auditor of all city properties of the McKinley electric lines succeeding L. L. Campbell of Champaign who returns to the position of auditor of disbursements, made vacant by the death of A. A. Price, killed in an interurban wreck at Staunton.

ALBERT D. FONGER, formerly chief clerk in the Chicago office of the General Electric Company, has resigned to take the position of assistant manager of the Electrical Engineers Equipment Company, Chicago. Mr. Fonger was connected with the General Electric Company for seventeen years, and his wide experience and large acquaintance in the electrical field will fit him excellently for his new position.

T. C. RINGGOLD is now general sales manager of the Central Electric Company of Chicago. Mr. Ringgold has been well known in Eastern jobbing circles, his more recent connections having been as sales manager of the Robertson Electric Company, the general manager of the Cataract Electric Supply Company, both of Buffalo, and last in a special capacity with the General Electric Company of Schenectady, N. Y.

JOHN S. BLEECKER, whose appointment as president of the new Georgia Section of the National Electric Light Association was noted in our last issue, was born in Washington, D. C., April 8, 1878. He is the son of Rear Admiral J. V. B. Bleecker, United States Navy, retired. After studying at the English High School, Boston, Mass., Mr. Bleecker graduated in the class of 1894 and then entered the Massachusetts Institute of Technology, from which he graduated in the class of 1898. He was employed in the Mechanical Department of the American Bell Telephone Company at Boston immediately after graduation and until 1900, when he entered the service of the Stone & Webster Corporation, with which he has remained up to the present tme. In the interest of this large holding system he has filled various capacities at Boston, Seattle, Houghton (Mich.), Blue Hill (Mass.), Paducah (Ky.), and Columbus (Ga.), the duties covering the wide range of lineman, motorman, inspector, clerk, superintendent and manager. To all of these duties Mr. Bleecker brought unbound youthful vigor and enthusiasm as well as an unusual fund of common sense and ability in the handling of men. At the present time he is manager of the Columbus Railroad Company, Columbus, Ga., one of the large public utilities of the South, operating the electric-railway system as well as a central-station plant. Mr. Bleecker married Miss Parks, of Nashville, Tenn., and has two children. He is a member of the St. Anthony Club, of Boston, and the Muscogee Club of Columbus, and is extremely popular in the South with whose interests he has thoroughly identified himself. He has taken a very active share in the work of the National Electric Light Association, has strongly advocated the formation of a state section for Georgia, and when steps were taken to create such a body he was the natural selection for presi-

dent. Mr. Bleecker is a man of striking presence, standing six feet four and weighing 210 pounds, and is, as well, a good public speaker.

OBITUARY.

BRIG. GEN. DAVID PORTER HEAP, who was the military representative of the United States at the Paris Congress of Electricians in 1881, died recently at his home in Pasadena, Cal. General Heap retired from active service in 1905 after forty years of service, being only sixty-eight years old at the time of his death. He was a member of the G. A. R., Royal Legion, New York Athletic Club, Army and Navy Club of Washington, and the Bohemian Club of San Francisco. He was the author of several works on engineering.

CAPT. HUGH R. GARDEN, who was vice-president and general counsel of the Sawyer-Man Electric Company in the middle eighties, died at Southport, N. C., on October 24, following a stroke of apoplexy. Captain Garden was born near Charleston, S. C., seventy-three years ago. He was a student at the University of South Carolina and, entering the cavalry, he served throughout the Civil War from its beginning to its end and afterward studied law at the University of Virginia. He came to New York about 1880 and developed a large and successful office practice. Captain Garden always took the greatest interest in the Southern Society of New York. He was a member of the Delta Kappa Epsilon fraternity and a number of other clubs and societies. His wife survives him.

FOREIGN TRADE OPPORTUNITIES.

(From *Daily Consular and Trade Reports*, issued by the Bureau of Manufacturers, Washington, D. C. In applying to the Bureau for addresses refer to file number.)

No. 5635. INQUIRIES FOR AMERICAN GOODS.—An American consular officer in a European country reports that he has received inquiries from a number of firms in his district, in response to a special letter addressed to such houses, in reference to catalogues and price lists of American firms manufacturing or handling machinery and other goods in their particular lines. The list of inquirers who desire such catalogues and information, includes one desiring electric lighting and power plants for country use and one interested in railroad building, street-car installation and special iron-working machinery. The names of the inquirers are on file in the Bureau of Manufactures.

No. 5653. ELECTRIC STREET-CAR LINE.—The concession for a street-car company in a Mexican city will expire in a short time. An American consul writes that the present system is on the old mule-car plan, but it is believed that if proper inducements were offered to the owner, whose concession will very likely be renewed, that arrangements could be made to change the system into a modern up-to-date electric street-car line. Correspondence, in Spanish, should be addressed to the owner, whose name has been furnished by the consul.

No. 5663. SPECIFICATIONS FOR ELECTRIC PLANT AND PUMPS.—A report from an American consul in the Far East states that bids are desired on plants for a residence now in course of construction in that region. Quotations are desired on one kerosene engine; one dynamo, four kilowatts, to furnish power for two hundred sixteen-candlepower Osram 100-volt lamps, one main switchboard, and usual fittings. Wiring of house separate. Bids are also desired on one kerosene engine, two and one-quarter brake-horsepower, directly coupled to pump, capable of pumping 1,000 gallons of water per hour within twenty-five feet vertical height to a distance of 600 feet against a head of 100 feet, including water tank, etc. It will be useless for American firms to bid on this contract unless machinery is carried in stock ready for delivery.

No. 5676. ELECTRIC LAMPS AND ELECTRICAL SUPPLIES.—An European firm advises an American consular officer that it desires to represent American manufacturers of incandescent electric lamps with metallic filaments, carbons for arc lamps, insulators, switches and arc lamps. Catalogues, prices, terms, etc., are requested. Correspondence may be in English if desired. References will be furnished.

NEW INCORPORATIONS.

MADISON, WIS.—The Independent Electrical Manufacturing Company, of Milwaukee, has filed papers here increasing its capital stock from $10,000 to $25,000. M.

WATERLOO, IOWA.—The Blackhawk Electrical Company, an electrical supply house has been organized here and with H. G. Rogers at the head, opened a store at LaFayette Avenue and East Fifth Street. Plans, as announced, call for an incorporation with a capital stock of $100,000. Z.

ANDERSON, IND.—The Morgan Register Company has filed articles of incorporation with the secretary of state. The object of said corporation is to engage in the manufacture, sale and distribution of a device for registering fares, the ventilation of cars and other devices used in the operation of railways. The capital stock is $100,000. The home and principal office will be located in Anderson. The directors are: Fred. A. Morgan, Henry A. Mansfield and Horace C. Stillwell. The above named corporation is the successor to the Morgan Fare Register Company, of Indianapolis, the property of the latter having been transferred to it.

NEW PUBLICATIONS.

REPORT OF CANADIAN MINES.—The Department of Mines of Canada has published a report of the analyses of ores, non-metallic minerals, fuels, etc., for the years 1906, 1907 and 1908. Only those analyses which are of some economic value are listed in the publication.

THE VOLATILE MATTER OF COALS.—Under this title was recently issued the first bulletin of the new Federal Bureau of Mines. The authors are Horace C. Porter and F. K. Ovitz, who conducted their investigations at the Pittsburg station while it was under the Technologic Branch of the Geological Survey. The tests described include systematic physical and chemical researches into the processes of combustion, concentrating attention on those lines of inquiry which promise results of greatest economic importance. This bulletin is, therefore, a report on an investigation of the volatile matter in several typical coals—its composition and amount at different temperatures of volatilization.

PROPOSALS.

BIDS FOR ELEVATORS.—The office of the Supervising Architect, Washington, D. C., announces that the time for opening the bids for an electric elevator equipment in the new Post Office Building at New York, N. Y., has been extended from November 3 to December 1.

POST OFFICE, SANTA CRUZ, CAL.—The office of the Supervising Architect, Washington, D. C., will receive bids until December 5, for the construction (including plumbing, gas piping, heating apparatus, and electric conduits and wiring) of the United States post-office at Santa Cruz, Cal., in accordance with drawings and specifications, copies of which may be had from the custodian of site at Santa Cruz, Cal., or at the Supervising Architect's office.

POST OFFICE, CARBONDALE, PA.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until December 8, for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States post office at Carbondale, Pa., in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at Carbondale, or at the Supervising Architect's office.

POST OFFICE, ROCK ISLAND, ILL.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until November 23, for the extension, etc., except elevator (including plumbing, gas piping, heating apparatus, electric conduits and wiring system), of the United States post office at Rock Island, Ill., in accordance with the drawings and specifications, copies of which may be obtained from the custodian at Rock Island, Ill., or at the Supervising Architect's office.

NAVY DEPARTMENT SUPPLIES.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on naval supplies on the dates given below. Bidders interested therein should make early application for copies of the schedule, giving the schedule numbers desired. Schedules can be obtained from the Navy Pay Office nearest each navy yard. Bids will be asked on the following supplies:

November 8—			
Cable, lead-covered	650 feet	Charleston, S. C.	3017
Conductor, three	4,671 feet	Philadelphia, Pa.	3017
Lamps, arc	30	Charleston, S. C.	3017
Motors, constant-speed, 1-horsepower	2	Philadelphia, Pa.	3017
Transformers, 10-kilowatt	7	Philadelphia, Pa.	3017
Wire, copper, weatherproof	3,050 pounds	Charleston, S. C.	3017
November 22—			
Winches and controllers, deck	2	Puget Sd., Wash.	3013

INDUSTRIAL ITEMS.

WICKES BROTHERS, Saginaw, Mich., have issued their monthly stock list of machinery bargains. The list includes the company's line of boilers, engines, pumps, tools, electrical machinery, etc.

THE BELDEN MANUFACTURING COMPANY, Chicago, Ill., has issued folders listing, and showing illustrations of, bare and tinned stranded copper cables and electrical clips, tips and terminals.

THE SHELBY ELECTRIC COMPANY, Shelby, O., has published a folder under the title "A Lamp for Rugged Service," and another, "Reflections." The former deals with the Shelby tantalum lamp, and the latter with the Shelby "top voltage" lamp.

HAGSTROM BROTHERS MANUFACTURING COMPANY, Lindsborg, Kans., has mailed to the trade a very neat and attractive glass paper weight advertising the Hagstrom spark plug. This plug is so constructed that the electrode points are at all times automatically kept clean.

DOSSERT & COMPANY, New York, N. Y., have just issued an eight-page folder which illustrates and describes a number of Dossert specialties. Especial attention is given to the new type of anchor connector for use with strain insulators, and to a new insulated cover for cable taps.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., describes, in a recent booklet, the Allis-Chalmers lighting transformers. Factors including safety, efficiency, weight, regulation, etc., are

covered and the general appearance of the transformer and its parts is well shown by several illustrations.

THE FRANKLIN ELECTRIC MANUFACTURING COMPANY, Hartford, Conn., is mailing to the trade an attractive folder featuring Franklin Mazda lamps. The text of the folder calls especial attention to the excellent organization of the Company and the resultant efficiency of service, at the same time inviting trial orders.

THE PENN-BRIDGE COMPANY, Beaver Falls, Pa., announces that for the convenience of its customers, Norton & Potter have been appointed Eastern agents, with offices in the Hudson Terminal Building, New York City. The Company is prepared to furnish estimates on ordinary bridge work or for the more difficult work of installing rolling lift bridges, canal locks, etc.

THE HOLOPHANE COMPANY, Newark, O., includes, in the October issue of *Holophane Illumination*, an interesting article on the illumination of study rooms, taken from a report of the lighting of midshipmen's quarters at the United States Naval Academy. In connection with the leading article on show-window lighting, an illustration of an extremely well-lighted window appears.

THE STONE & WEBSTER ENGINEERING CORPORATION, Boston, Mass., has incorporated in the form of a booklet, a number of views and plans of power stations designed and built by it. Each illustration is accompanied by a short description giving points as to capacity and character of apparatus installed at the plant shown. The publication is arranged in a very attractive manner.

THE GUARANTEE ELECTRIC COMPANY, Chicago, now holds monthly meetings of its executive officers and salesmen. The object of these meetings is to get closer together so as to run the business more in accordance with the wishes of its patrons. The last meeting of the company was held October 17, and while only two or three meetings have been held the benefits are already noticeable.

THE MINNEAPOLIS STEEL & MACHINERY COMPANY, Minneapolis, Minn., has incorporated a new idea in the arrangement of its monthly stock list. This list, which has previously been sent in two parts, mechanical and structural, has now been incorporated into one pamphlet. To avoid any possibility of confusion one of these lists start at each end of the booklet, both going towards the middle.

THE ROCHESTER MACHINE TOOL COMPANY, Rochester, N. Y., will shortly move into a new three-story building which it is constructing on Allen Street, Rochester. The Company will greatly increase its equipment and facilities. The Acme engine, manufactured by this company, is meeting with increasing popularity for all installations where a highly-efficient engine of small capacity is desired.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., describes in a recent bulletin its complete line of metal moldings, rosettes, outlets, etc. The molding described consists of two pieces, base and capping, so formed that the capping snaps over the base. A number of points on installation are included in the booklet, and several illustrations of the process of putting the molding in are given.

THE CENTURY ELECTRIC COMPANY, St. Louis, Mo., has issued an attractive booklet on the subject of "Century" single-phase motors. A detailed description of the design, construction, operating characteristics of these repulsion motors is given in connection with numerous illustrations. The motor is shown separately and also in connection with a number of motor-driven machines including saws, pumps, vacuum cleaners, etc.

THE BRISTOL COMPANY, Waterbury, Conn., has just distributed to the trade a number of bulletins which with the serial numbers are as follows: No. 128, Bristol's Round Form Class II Recording Thermometers; No. 129, Bristol's Thermometer-Thermostats; No. 135, The Wm. H. Bristol Recording Shunt Ammeters; No. 141, Bristol's Round Form Recording Pressure Gauges; No. 145, Bristol's Class II Indicating Thermometer; No. 147, Bristol-Durand Radii Averaging Instrument. Attention is particularly called to the new model of Bristol's recording pressure gauges equipped with six-inch charts as illustrated in Bulletin No. 141. Radically new lines of instruments are also illustrated in Bulletins Nos. 145, 146 and 147.

THE WIRT ELECTRIC SPECIALTY COMPANY, Philadelphia, Pa., announces that it will be known under this name instead of as the "Di-el-ite Manufacturing Company," as formerly. No change will be made as to management or business policy, except in the way of increasing the Company's facilities. There is an abundance of floor space in the firm's new quarters at Cirmat and Lena Streets, and it is expected that four times the former amount of business can be conveniently handled.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has just issued a circular, No. 1161, on the subject of its Type G, belt-driven alternating-current generators. These generators are especially designed to meet the needs of industrial plants and smaller central stations and have proved very successful in this class of service. Simplicity of electrical and mechanical construction, and economy in operation and maintenance are the characteristics of these generators.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Pittsburg, Pa., has just issued its Circular 1098 on the subject of Switchboard Indicating Meters. The publication outlines the cardinal points to be kept in mind in the selection of meters. It describes direct current and alternating current indicating meters, including frequency meters and power factor meters; synchroscopes; and instrument transformers. It is pointed out in the circular that with the development of switchboard design has come the necessity for various types and forms of indicating meters, each adapted to its own peculiar purpose. The Company has also issued a revision of its Circular 1118 on the subject of its Type CCL polyphase induction motors. The circular describes the electrical and mechanical features of these motors and shows some very interesting pictures of their applications. The circular also includes some short descriptions of the various starting devices used with squirrel cage induction motors.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., recently issued a number of bulletins dealing with machinery, appliances and lighting supplies. The first of these, No. 4763 supersedes the previous bulletins on direct-current combination generator and feeder panels. Bulletin No. 4766 illustrates and describes General Electric tantalum lamps for 100 to 125 and 200 to 250 volts, at the same time comparing the cost and efficiency of the lamps with those of the carbon and Gem lamps. Bulletin No. 4769, on train lighting with General Electric Mazda and tantalum lamps is of especial interest to those connected with that branch of illumination. Bulletin No. 4771 entitled "Hand-Operated Starting Compensators for Alternating-Current Motors," supersedes all previous bulletins on that subject. The material in Bulletin No. 4772 on electric automobile appliances contains much of interest to the user of the pleasure or commercial electric-vehicle user. The bulletin illustrates and describes an outfit for charging the storage batteries, as well as a combination ammeter and voltmeter for automobiles. It illustrates Mazda lamps for head-light, side-light and tail-light, and also a lamp for limousine illumination. Automobile motors, controllers, and air compressor outfits, are illustrated and described. Bulletin No. 4774 supersedes the old bulletin on the subject of centrifugal air compressers.

DATES AHEAD.

American Association of Electric Motor Manufacturers. Semi-annual meeting, Chicago, November 14-16.

Alabama Light and Traction Association. Annual meeting, Anniston, Ala., November 21-23.

American Physical Society. Annual meeting, Chicago, Ill., November 25 and 26.

American Association for the Advancement of Science, and affiliated societies. Minneapolis, Minn., December 27-31.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) October 25, 1910.

973,507. HYDROCARBON-ENGINE IGNITION SYSTEM. Russell Huff, Detroit, Mich., assignor, to Packard Motor Car Company, Detroit, Mich. Filed June 15, 1906. A high-tension ignition system for automobiles.

973,508. POTENTIAL SWITCH. John D. Ihlder, New York, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed April 9, 1906. Combined with a potential switch, is a manual device for opening the switch, with magnetic means for holding the switch closed, and means co-acting with the manual device for varying the magnetic power of the magnetic means, and thereby effecting the release of the potential switch.

973,525. MOTOR-CONTROLLER., William B. Lucas, Chicago, Ill. Filed March 10, 1909. The terminals of a fixed starting resistance are carried by a rotary element and are automatically short-circuited when the speed of the motor is accelerated.

973,535. PROCESS OF MANUFACTURING FILAMENTS AND THE FILAMENT PRODUCED THEREBY. Georges Michaud and Eugène Delasson, Montreuilsous-Bois, France. Filed October 30, 1907. The process of producing incandescing filaments consists in mixing together substantially ninety-nine parts of oxide of thorium, one part of oxide of cerium and traces of oxide of chromium, combining substantially eighty parts of this mixture with substantially twenty parts of alumina, adding to this final mixture black soap as agglomerant, forming the composition into a filament, subjecting the filament to an increasing temperature until a pasty fushion of the ingredients

is obtained, and afterward gradually subjecting the filament to a decreasing temperature until it is hardened.

973,553. AUTOMATIC REWINDING DEVICE FOR ELECTRIC-LIGHT CORDS. George J. Peacock, Albuquerque, N. Mex. Filed June 14, 1910. Includes a stationary, hollow, drum, a frame removably held within the drum, a mechanism within the frame including a rotary spindle and a rewinding spring, an arm secured to, and projecting exteriorly of the drum from the spindle, and a guide sheave carried by the arm.

973,555. LIGHTING-ARRESTER. Frank W. Peek, Jr., Schenectady, N. Y., assignor to General Electric Company. Filed February 2, 1910. A condenser with one terminal is connected to ground and a rectifier is connected to the other terminal of the condenser and to the circuit to be protected.

973,557. INSULATING MATERIAL. Charles F. Peterson, Schenectady, N. Y., assignor to General Electric Company. Filed June 22, 1907. An insulating material consists of fragments of mica pasted together by a material comprising kaolin and silicate of soda.

973,558. ADJUSTABLE JOINT FOR ELECTRIC-LIGHT FIXTURES. Edwin F. Pierce, Milwaukee, Wis. Filed April 12, 1909. A ball-and-socket arrangement.

973,560. TERMINAL FOR ELECTRICAL APPARATUS. William B. Potter, Schenectady, N. Y., assignor to General Electric Company. Filed September 7, 1907. In combination with an air-tight casing, is an insulating tube forming a tight fit therewith, with a conductor passing through the tube and having a sleeve yieldingly connecting with a tapered surface within the tube.

973,565. MEANS FOR VENTILATING DYNAMO-ELECTRIC MACHINES. Henry G. Reist, Schenectady, N. Y., assignor to General Electric Company. Filed October 26, 1096. In a dynamo-electric machine having stator and rotor members, is a casing forming a closed chamber at one end of these members, and means are provided for producing a flow of air into the chamber through the space surrounding the rotor, the stator having ventilating passages leading from the chamber to points remote from the uninclosed end of the rotor.

973,567. SIGN-RECEPTACLE FASTENING. Frank J. Russell, New York, N. Y. Filed October 9, 1908. Includes a one-piece fastening part.

973,568. SIGN-RECEPTACLE FASTENING-EYELET. Frank J. Russell, Brooklyn, N. Y. Filed October 26, 1909. Similar to the preceding.

973,575. MOTOR CONTROL. Walter I. Slichter, Schenectady, N. Y., assignor to General Electric Company. Filed June 23, 1909. The method of operating electric motors mechanically connected to drive a common load, and connected electrically in groups, consists in starting the motors by impressing reduced voltages on the groups, and increasing the voltages on the groups alternately.

973,579. VOLTAGE-REGULATOR. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company. Filed June 9, 1909. The method of regulating the voltage of one or more phases of a polyphase system independently of the other phases, consists in adding to the voltage of the phase to be regulated a regulating voltage which is substantially in quadrature with the voltage of the adjacent phase and so does not affect the latter.

973,586. ELECTRICAL WELDING OF SHEET METAL. Elihu Thompson, Swampscott, Mass., assignor, by mesne assignments, to Thomson Electric Welding Company, Lynn, Mass. Filed October 21, 1909. The method of uniting two sheets of metal at one or more isolated spots of union, consists in providing a sheet with a tongue or tongues cut from the body of a sheet and bent over on the surface thereof, placing another sheet over same, and applying heating electric current and pressure.

973,590. ELECTRIC BRAKING. John F. Tritle, Schenectady, N. Y., assignor to General Electric Company. Filed May 2, 1910. The motor is made to act as a braking generator, and return current to the source, by separately exciting the field winding and automatically compounding the excitation to compensate for varying speeds.

973,592. SOLDERING-IRON. Tycho Van Aller, Schenectady, N. Y., assignor to General Electric Company. Filed July 17, 1908. Comprises a metallic body provided with a plurality of slots, flat heating units within the slots, and means for pressing the service of the slot into intimate thermal relation with the conductor throughout its length.

973,593. ELECTRIC FLATIRON. Tycho Van Aller, Schenectady, N. Y., assignor to General Electric Company. Filed February 18,1909. An electric flatiron comprises a body having its outer portion of thicker metal than its inner portion and a resistance unit arranged to apply heat to the outer portion.

973,611. GYROSCOPE. Hermann Anschutz-Kaempfe, Kiel, Germany. Filed October 2, 1907. A gyroscope apparatus comprises a casing, liquid within the casing, a vertical spindle therethrough, an inner casing upon the spindle, a frame within the casing and connected to the spindle, a plurality of flywheels upon the frame, and electrical contacts operated by the movements of the flywheels.

973,613. CIRCUIT-CONTROLLER. Winfield A. Atwood, Schenectady, N. Y., assignor to General Electric Company. Filed February 16, 1909. A fuse is pivotally mounted on an insulating support (mounted on the movable terminal) to swing into and out of engagement with the movable terminal and to engage both movable and fixed terminals when in circuit-closing position.

973,627. ELECTRICAL ALARM SYSTEM. Frank Castle, Auckland, New Zealand, assignor of two-fifths to Edward Joshua Riddiford, Wellington, New Zealand; two-fifths to William Edward Bidwill, Featherston, New Zealand, and one-tenth to Leslie Louis McDermott, Auckland, New Zealand. Filed June 8, 1910. In combination with a close-lined wire circuit are two relays of respectively differential resistances arranged in such circuit, an alarm indicator circuit adapted to be operated by the movement of each relay armature, and means whereby the differential resistances of the relays may be overbalanced upon the operation of a thermostat or other local circuit.

973,644. AEROPHONE. Lee de Forest, New York, N. Y., assignor, by mesne assignments, to De Forest Radio Telephone Company. Filed November 12, 1906. In a system for transmitting articulate speech by free and unguided electromagnetic waves is an elevated conductor for radiating said waves, with a single-arc circuit connected to and operating to create high-frequency electrical oscillatons in the elevated conductor, and means associated with the circuit for varying the amplitude of the oscillations therein by and in accordance with sound waves.

973,645. LIGHTNING-ARRESTER. Frank T. Forster, Schenectady, N. Y., assignor to General Electric Company. Filed February 10, 1909. An electrolytic cell comprises a vessel containing an electrolyte, a cover having an opening therethrough, an electrode having an integral ear for extending into the opening, a lug secured to the ear by a joint which is in the opening when the electrode is in place, and a stopper for the lower end of the opening co-operating with the ear to protect the joint between the ear and the lug.

973,653. ARC LAMP. Cromwell A. B. Halvorson, Jr., Saugus, Mass., assignor to General Electric Company. Filed January 28, 1909. In an arc lamp with weldable electrodes are means for feeding one electrode into forcible contact with the other and moving it bodily and then separating them for establishing the arc, and means for tilting the arcing face of one of the electrodes by the force of the contact with the other.

973,657. HIGH-POTENTIAL SWITCH. Edward M. Hewlett and Theodore E. Button, Schenectady, N. Y., assignors to General Electric Company. Filed January 7, 1902. An electric switch comprises a movable switch member to open and close the circuit, a spring for closing the switch, an independent spring to open it, a motor to store energy in either spring prior to its action on the member, and means for controlling the motor.

973,672. CURRENT COLLECTOR FOR ELECTRICALLY-PROPELLED VEHICLES. Willy Kohler, Bremen, Germany. Filed March 17, 1910. A loop or U-piece with spring-connected arms has one arm depending from a trolley or traveling current-collector and the other secured to the cable proper.

973,676. ANNUNCIATOR. Adam Lungen, New York, N. Y., assignor to Edwards & Company, Inc. Filed November 20, 1909. An electromagnetic annunciator.

973,703. INCANDESCENT ELECTRIC LAMP. Thomas E. Robertson, Catford, England, assignor to General Electric Company. Filed November 2, 1908. The filaments are tensioned by a resilient anchor or anchors.

973,736. PRODUCTION OF LIGHTING EFFECTS ON STAGES BY MEANS OF HIGH-TENSION CURRENTS OF HIGH FREQUENCY. Camilla Feher Zhaniel, Charlottenburg, Germany. Filed July 7, 1909. Theatrical garments or decorations are impregnated with powderd conducting material and the articles thus prepared are introduced into high-tension circuits of high frequency.

973,737. DEVICE FOR CONTROLLING THE CONSECUTIVE OPERATION OF ELECTROMAGNETS. Frans G. Agrell, Stockholm, Sweden. Filed February 27, 1907. In combination with a series of releasable members adapted to perform a mechanical operation are a series of mechanically co-operating releasing members operative to release one of the releasable members, and means for operating the releasing members.

973,747. PULL SOCKET. Thomas H. Brady, New Britain, Conn. Filed March 18, 1909. Describes the mechanism in detail.

973,762. SELECTOR SWITCH. Edward B. Craft, Chicago, Ill., assignor to Western Electric Company, Chicago, Ill. Filed November 23, 1907. A telephone selector is described in detail.

973,776. PROCESS OF EXTRACTING METALS FROM THEIR ORES. William E. Greenawalt, Denver, Colo. Filed May 25, 1909. A process of extracting metals from their ores containing copper, consists in treating the ore with an acid solution to dissolve the copper and other metals; applying sulphur

dioxide to the solution in the presence of a metal chloride, electrolyzing the cuprous and other metal chlorides to deposit the copper and other metals and liberate chlorine, subdividing the solution; then bringing the chlorine so liberated in contact with the solution in the presence of sulphur dioxide, returning the regenerated acid solution to the ore, and repeating the cycle as before, until the metals in the ore are sufficiently extracted.

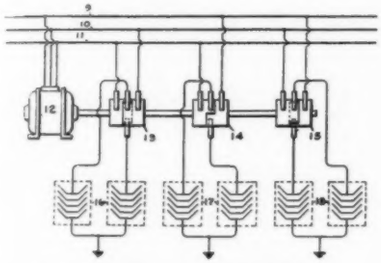
973,808. SIGNALING SYSTEM. Emory Parsons, Chicago, Ill. Filed August 20, 1908. An electric selective system.

973,818. CIRCUIT-CLOSING DEVICE. Leslie R. Saunders, Los Angeles, Cal. Filed February 21, 1910. A motor-driven revoluble actuator periodically moves a contact element to circuit-closing position.

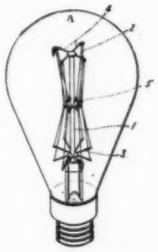
973,826. ELECTRICAL OSCILLATOR. Frederick K. Vreeland, Montclair, N. J., assignor to Wireless Telegram Exploitation Company, New York, N. Y. Filed December 15, 1906. Describes electrical oscillator wherein are combined an oscillating circuit, a vacuum tube and means for producing an axial magnetic field for concentrating and directing the cathode blast.

973,836. BRUSH FOR DYNAMO-ELECTRIC MACHINES. Henry L. Zabriskie, Brooklyn, N. Y., assignor to Diehl Manufacturing Company. Filed August 19, 1908. In combination with a brush-block formed with a recess are an anchorage of high conductivity disposed within the recess, means for clamping the anchorage firmly in electrical contact with the wall of the recess of the brush-block, a flexible conducting lead, and a connection intermediate the lead and the anchorage.

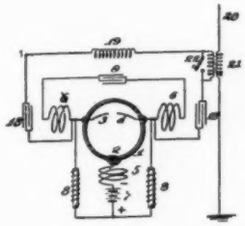
973,838. COIL FOR ELECTROMAGNETS. Christian Aalborg, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed June 4, 1906. A magnet coil comprises a tubular shell and a plurality of webs extending through the shell from side to side, the shell having side slots between the ends of adjacent webs and diagonal slots joining the ends of each side slot with the ends of the next slot in the series at the opposite side of the shell.



973,555.—LIGHTNING ARRESTER.



973,703.—INCANDESCENT LAMP.



973,826.—OSCILLATOR.

973,839. AUTOMATIC PIANO-PLAYER. Alexander A. Aarons, New York, N. Y. Filed February 5, 1910. There are a plurality of electrically operated devices for actuating the keys of a piano, a parallel circuit for each of the electrical devices, means for controlling the flow of current to the electrical devices, a common conductor for the parallel circuits, a rheostat located in the common conductor, provided with a movable circuit closer, means (for actuating the circuit closer) comprising a solenoid and a longitudinally movable core actuated thereby, and means for controlling the extent of movement of the core.

973,873. SPARK-PLUG FOR EXPLOSIVE ENGINES. Martin T. Minogue, Philadelphia, Pa., assignor to the Superior Motor Specialty Company, New York, N. Y. Filed Decmber 18, 1909. A spark plug has an insulating member with projecting electrode, a device for holding the insulating member to the plug, and a finger having an insulating pivotal mounting upon the holding device which permits of swinging movement of the finger in order to form a spark gap on the outside of the plug.

973,878. ELECTRIC MOTOR. Edwin S. Pillsbury, St. Louis, Mo., assignor to Century Electric Company. Filed May 14, 1910. A laminated field pole comprises a plurality of teeth, the tooth at one side thereof being of thicker laminas than the tooth at the opposite side.

973,883. PRODUCTION OF INCANDESCENT-ELECTRIC-LAMP FILAMENTS. Waldemar Ruhling, Berlin, Germany, assignor to Hermann Maiachowski, Berlin, Germany. Filed November 15, 1909. An incandescent electric lamp has a carbon filament with a coating containing antimony deposited thereon.

973,885. CURRENT CONTROLLER. Frank L. Sessions, Columbus, Ohio, assignor to the Jeffrey Manufacturing Company. Filed January 7, 1904. Renewed February 23, 1909. Includes a current-switching and resistance-controlling mechanism, the resistance controlled thereby, and oppositely wound blow-out magnets and arranged at either end of the current-switching and resistance-controlling mechanism, and having their energizing coils connected in parallel with the resistance.

973,889. ELECTRICAL CIRCUIT BREAKER. Harve R. Stuart, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed February 6, 1906. In combination with a plurality of circuit-breakers is a single closing handle therefor having projections for the respective breakers which severally serve as both closing and tripping members. There are devices for retaining the circuit-breakers in closed position, an electromagnetically actuated means for withdrawing each retaining device, and means for actuating the projections of the other circuit-breakers to effect withdrawal of their retaining devices.

973,899. ELECTRICAL APPARATUS FOR PERFORATING DESIGNS. Boo Henning Wallin Gottenborg, Sweden. Filed February 25, 1910. An electromagnetic perforator.

973,913. FLASH-LIGHT SIGNALING APPARATUS. George Herbert Butterworth and Edmund Veevers, Liverpool, England. Filed February 19, 1909. A continuously lighted lamp is adapted to shine all around; a solenoid is located co-axially with the lamp; and a tubular core for the solenoid forms a screen for the lamp and is adapted to expose the latter when withdrawn therefrom by the solenoid.

973,924. CIRCUIT-BREAKER. James C. Dow, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed July 13, 1907. Includes a release magnet, etc.

973,926. ELECTRIC BRAKE. Robert R. Dunlop, Columbus, Ohio, assignor to the Jeffrey Manufacturing Company. Filed January 17, 1905. A brake for controlling the speed of rotation of the armature of a dynamo-electric machine is operated by an electromagnet, and a triple-pole double-throw switch is adapted when in one position to connect the machine with the source of current supply and to short-circuit the energizing coil of the electromagnet, and when in its other position to connect the energizing coil of the magnet into the machine circuit.

973,938. CIRCUIT INTERRUPTER. Ford W. Harris, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company. Filed December 14, 1908. Has a manually operable contact member, electromagnetic release, etc.

973,951. ELECTROPLATING PROCESS. Francis J. McElhone, Jersey City, N. J. Filed June 9, 1906. The process consists in treating the graphite covering for a type mold with an organic acid and electro-plating thereafter.

973,984. MAGNETIC ORE SEPARATOR. Charles A. Sellon, Halleck, Cal. Filed November 16, 1909. A magnetic plate arranged in the bottom of a trough consists of sheet metal of double thickness with a nonmagnetic filling. Magnets are arranged on the plate.

973,997. METHOD OF OPERATING VAPOR ELECTRIC DEVICES. Percy H. Thomas, Montclair, N. J., assignor to Cooper Hewitt Electric Company, New York, N. Y. Original application filed January 27, 1905. Divided and this application filed April 12, 1905. The method of insuring the starting of a vapor-electric apparatus having a plurality of positive electrodes and two negative electrodes, consists in applying to the positive electrodes an alternating electromotive force capable of traversing the apparatus under normal conditions of operation through either negative electrode, affecting the negative electrodes by an inferior alternating electromotive force sufficient to locally break down the negative electrode reluctance on each separation of the negative electrodes and causing such separation.

974,008. ELECTRODE. Raphael H. Wolff, New York, N. Y. Filed January 14, 1910. The preparation of an electrode consists in forming several parts of the electrode so that one part can be inserted into another to be retained therein, and filling the spaces or interstices with suitable material.

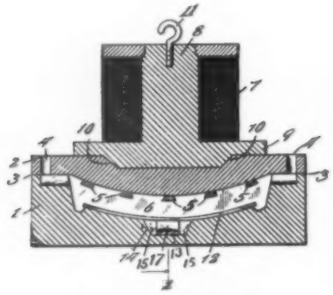
974,016. HOLLOW CARBON ELECTRODE FOR GALVANIC ELEMENTS. Stephan Benko, Budapest, Austria-Hungary, assignor to the Company Limited for Exploitation of Inventions by Stephan Benko, Budapest, Austria-Hungary. Original application filed January 19, 1909. Divided and this application filed March 25, 1910. A galvanic element comprises a hollow porous negative electrode provided with perforations extending com-

pletely therethrough, a positive electrode inserted in the hollow, an electrolyte containing a depolarizing gas, a metal rim attached to each end of the negative electrode by being compressed into the perforations, an acid-resisting casing carried by the rims and completely inclosing the outer surface of the negative electrode, but being situated a small distance from the surface so as to form an inclosed space therearound, means opening into the space for admitting the electrolyte containing the depolarizing gas, and means for passing the electrolyte and depolarizing gas simultaneously from the said space through the pores of the negative electrode to the positive electrode.

974,017. FIRING INDICATOR AND RECORDER. Asa White Kenney Billings, Habana, Cuba. Original application filed May 20, 1909. Divided and this application filed August 4, 1909. An electric circuit for each heating device includes certain indicating signals and the circuit is automatically completed at the end of each predetermined firing interval.

974,024. METAL FOUNDING. Charles B. Carter, Chicago, Ill. Filed August 24, 1910. The method of making castings containing inserts of magnetizable metal consists in holding the inserts in place in the mold by magnetic action, pouring the molten metal into the mold, and allowing it to cool and harden about the inserts thus held.

974,029. ELECTROLYTIC CONDENSER. Elmer E. F. Creighton, Schenectady, N. Y., assignor to General Electric Company. Filed October 26, 1907. An electrolytic cell comprises an electrolyte, aluminum plates mounted in contact with the electrolyte to form electrodes, and insulating supports for engaging the edges of the plates to hold them in definite relation to one another and out of metallic contact.



974,024.—FOUNDING.

974,037. MERCURY-VAPOR LAMP. Leonard E. Dempster, Schenectady, N. Y., assignor to General Electric Company. Filed March 27, 1905. A vapor electric apparatus includes a mercury electrode, a plunger floating in the mercury electrode, a body of conducting liquid carried by the plunger and insulated from the mercury electrode, a filament dipping in the conducting liquid, and means for moving the plunger.

974,047. LIFTING MAGNET. Clayton E. Frederickson, San Francisco, Cal., assignor of twenty-five per cent to Gordon S. Chamberlin and thirty-seven and one-half per cent to Earl D. McCaddam, San Francisco, Cal. Filed June 11, 1910. A lifting magnet includes a core tube, a pair of coils wound to present a consequent pole intermediate the ends of the magnet, an outer tube and end closure rings to form a housing for the coils.

974,063. SYSTEM OF ELECTRICAL DISTRIBUTION. Albert S. Hubbard, Greenwich, Conn., assignor to Gould Storage Battery Company. Original application filed February 20, 1902. Divided and this application filed July 22, 1903. The system comprises a generator, a distribution circuit, a storage-battery connected therewith, a booster in the battery connection, field windings for the booster, one of the windings in series with the generator, and an induction device responsive to load fluctuations in the distribution circuit, and connected with the other of the booster field windings.

974,069. TIMER FOR AUTOMOBILES. William S. Jones, Ossining, N. Y. Filed February 25, 1910. An automobile timer timing-ring includes a main section formed with a half bearing and with an opening extending from the bearing, and an adjusting section fitting in the opening and carrying a half bearing to co-operate with the half bearing of the main section.

974,090. LAMP AND REFLECTOR THEREFOR. Dennis Joseph O'Brien, San Francsico, Cal., assignor, by mesne assignments, to Straight Filament Lamp Company. Filed November 16, 1903. Renewed November 20, 1909. A reflector has laterally projecting conductors, and means are provided for engaging the side of the lamp adjacent to the reflector and which terminates short of the circumference of the lamp.

974,106. ELECTRICAL SWITCH. Albourne F. Furbush, Cliftondale, Mass., assignor to himself, and Charles W. Hale, Hartford, Conn. Filed July 7, 1910. Comprises a base plate, a pair of contact points stationary thereon and insulated from each other, a slide movable on the base plate, a pair of contact points carried by the slide and insulated from each other, a fuse member connecting the contact points of the slide, means for reciprocating the slide, and a device normally locking the slide against movement and operable to release such slide during and by the final movement of the reciprocating means.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired October 31, 1910:

507,522. ELECTRICAL STEERING-GEAR. Charles W. Ayton, New York, N. Y.

507,526. ELECTRICAL TRANSFORMER. William J. Carstarphen, Jr., Denver, Colo.

507,539. ICE-SCRAPER FOR TROLLEY WIRES. William Heston, Alliance, Ohio.

507,547. SERIES MULTIPLE ELECTRIC CONTROLLER. Arthur P. Knight, Boston, Mass.

507,554, 507,555, 507,556, 507,557 and 507,558. INCANDESCENT ELECTRIC LAMP. William E. Nickerson, Cambridge, Mass.

507,565. TEST AND SIGNAL CIRCUIT AND APPLIANCE. Theodore Spencer, Cambridge, Mass.

507,568. TELEPHONE-CIRCUIT. John S. Stone, Boston, Mass.

507,569. ELECTRO-PROTECTIVE SYSTEM. Frederic G. Storey, Cambridge, Edward R. Andrews and John P. Cushing, Boston, and Howard F. Eaton, Quincy, Mass.

507,585. AUTOMATIC TIME-RECORDER. Issac N. Lewis, Fort Wadsworth, N. Y.

507,589. ELECTRIC CAR-BRAKE. Joseph H. McEvoy, Waterbury, Conn.

507,590. AUTOMATIC BATHOMETER AND SHOAL WATER INDICATOR. Nicolaus Potschinsky, Odessa, Russia.

507,600. LUMINOUS FOUNTAIN. Paris E. Singer, London, England.

507,606. ELECTRIC-RAILWAY SUPPLY SYSTEM. Granville T. Woods, New York, N. Y.

507,629. SYSTEM FOR OPERATING ELECTRIC MOTORS. Edmund C. Morgan, Chicago, Ill.

507,658. ELECTRIC MOTOR. John F. Kelly and Cumming C. Chesney, Pittsfield, Mass.

507,660. MAIL-BOX. August Krastin, Cleveland, Ohio.

507,671. ELECTRICALLY-OPERATED MACHINE FOR MOLDING CLAY OR CEMENT PIPES. Reinhold Boeklen, Omaha, Nebr.

507,678. INSULATING COMPOUND. John J. Fanning, Chicago, Ill.

507,690. LAMINATED FIELD-MAGNET FRAME FOR DYNAMO-ELECTRIC MACHINES. Abdrew L. Riker, New York, N. Y.

507,691. ELECTRIC-CIRCUIT TESTING AND SWITCHING DEVICE. Miner Robinson, Newton, Mass.

507,694. TELEPHONE-TRANSMITTER CIRCUIT AND APPARATUS. John S. Stone, Boston, Mass.

507,703. ELECTRICALLY-OPERATED PIANO. Lawrence J. Zimmerman, Linden, N. J.

507,708. GALVANIC BATTERY. James A. S. Gregg, New Rochelle, N. Y.

507,714. ELECTRIC LAMP SHADE AND HOLDER. Albert S. Marten, East Orange, N. J.

507,715. TELEPHONE TRANSMITTER. James H. Mason, Brooklyn, N. Y.

507,728. TELEPHONE. Stephen D. Field, Stockbridge, Mass.

507,733. TROLLEY FOR ELECTRIC RAILWAYS. Gustavus A. Huben, Springfield, Ohio.

507,768. ELECTRIC COIN-CONTROLLED FORTUNE-TELLING MACHINE. Adolph Waldman, St. Louis, Mo.

507,769. MOTOR. William J. Walker and Alexander L. Bedford, St. Louis, Mo.

507,791. MACHINE TELEGRAPHY. Patrick B. Delany, South Orange, N. J.

507,803. COMBINED SWITCH AND CUT-OUT FOR ELECTROLIERS. Iczak Goldkind, Max Stirn, and Louis Stirn, New York, N. Y.

507,806. CONDUIT RAILWAY-CONDUCTOR. John W. Grantland, Philadelphia, Pa.

507,869. ELECTRIC SIGNAL APPARATUS. John C. A. Xiezopolski and Charles Bode, Milwaukee, Wis.

507,916. ELECTRIC-ARC LAMP. William B. Luce, Brookline, Mass.

507,918. ELECTRIC TRAIN AND SWITCH SIGNAL DEVICE. George E. Miller, Saugus, Mass.

507,925. ELECTRIC BURGLAR-ALARM. Thomas S. Patty, Cooper, Iowa.

507,941. ELECTRIC HEATER. William Snee, Pittsburg, Pa.

507,945. SYSTEM OF ELECTRICAL TRANSMISSION OF POWER. Charles J. Van Depoele, Lynn, Mass.; C. A. Coffin, and Albert Wahl, administrators of said Van Depoele, deceased.

507,946. PORTABLE ELECTRIC PUMP. Charles J. Van Depoele, Lynn, Mass.; C. A. Coffin and Albert Wahl, administrators of said Van Depoele, deceased.

507,959. ELECTRIC ALARM-CLOCK. Charles F. Wyman, Minneapolis, Minn.